KAM
KPC-4
KPC-2400
KPC-2
KPC-1

Installation Manual

Kantronics
RF Data Communications Specialists

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RF Data Communications Specialists

1202 E. 23rd Street, Lawrence, Kansas 66046
Order number (913) 842-7745
Service / Technical Support (913) 842-4476
9 am - noon, 2 pm - 5 pm Central Time, Monday-Friday
FAX number (913) 842-2021
BBS number (913) 842-4678 300/1200/2400,N,8,1
5 pm - 8 am Central Time, Monday-Friday, All Day Weekends

The KAM, KPC-4, KPC-2400, KPC-2 and KPC-1 are Kantronics hardware and software designs incorporating the AX.25 Version 2 Level 2 Packet protocol as adopted by the American Radio Relay League. This manual contains information from earlier KPC-1, KPC-2, KPC-2400, KPC-4, and KAM manuals and addendums, modified as appropriate. In addition, Kantronics acknowledges the use of material from the original Tucson Amateur Packet Radio Corporation (TAPR) TNC-1 manual granted by OEM agreement.

We have attempted to make this manual technically and typographically correct as of the date of the current printing. Production changes to the TNC may add errata or addendum sheets. We solicit your comments and/or suggested corrections. Please send to Kantronics Inc., 1202 E. 23rd Street, Lawrence, KS 66046.

Printed in the U.S.A.

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Limited Warranty

Kantronics Company, Inc. warrants to the first consumer purchaser, for a period of one year from the date of purchase, that this product will be free from defects in material and workmanship, and agrees that it will, at its option, repair or replace the defective parts or the product at no charge for parts or labor.

This warranty does not apply to the cosmetic appearance of the product, or to any product that has been subject to misuse, abuse, overvoltage, or other cause beyond our reasonable control.

This warranty does not apply to any unit that has been modified by the consumer unless specifically authorized by Kantronics Company, Inc, in writing.

In no event shall Kantronics be held liable for damages due to fire, flood, civil disobedience, riot, acts of God or damages incurred in shipping due to poor packaging. Kantronics shall not be held liable in the event the defect is found to be caused by improper parameter settings which are cleared by performing a hard reset.

Kantronics shall not be liable for any incidental or consequential damages arising from the use of the product or due to the non-availability for use of the product under any circumstances.

Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

In order to enforce the rights under this limited warranty, the purchaser should mail, ship or carry the product, together with proof of purchase, to Kantronics Company, Inc, 1202 East 23rd Street, Lawrence, Kansas 66046. The consumer must also provide adequate proof of purchase indicating the date the product was purchased.

There are no other warranties, including the implied warranty of fitness for a particular purpose, not specified herein with regards to this product. Neither the sales personnel of the seller nor any other person is authorized to make any warranties other than those described herein, or to extend the duration of any warranties beyond the time period described above.

This warranty is not assignable by the original consumer. Any attempt to assign or transfer any of the rights, duties or obligations hereof is void.

Any product returned for warranty service and our inspection and testing shall determine no defect exists which is covered by this warranty, shall be charged a minimum of one-half hour labor plus return shipping charges.

This warranty gives you specific legal rights and you may also have other rights which vary from State to State.

Return/Repair Procedures

Consult the limited warranty policy in this manual for the service provisions offered by Kantronics at no charge. This warranty is considered to be in force only when the customer has submitted his completed warranty registration within 10 days of purchase, and when the stipulations of the warranty have been met. Violations of warranty clauses will automatically void the warranty and service or repairs will be charged to the owner.

Service outside the warranty will be charged at the cost of parts, labor, and return shipping. Units returned for service without a Return Authorization number will be subject to a minimum charge of 1/2 hour labor plus shipping and handling. Contact the Service Department (913-842-4476) to obtain a Return Authorization number. Repaired units will be returned via UPS C.O.D. These C.O.D. charges can be avoided by including your VISA or MasterCard number with your unit to be repaired. Shipping and repair may then be charged.

When service or repairs appear necessary, it may be wise to call or write Kantronics to determine if the problem can be solved without returning the unit. Should you encounter difficulty in getting your TNC to "talk" to your computer, you may wish to perform some limited checks before calling or writing. Carefully check your wiring connections to the RS-232 port. Verify your terminal baud rate. It may be useful to perform a "Hard Reset". (See Hard Reset section.)

When calling, report the product name and ask for the Amateur Radio Service Department. Should you find it necessary to call for assistance, please have the following information available:

1. The unit name and serial number (the serial number is found on the rear panel.)

2. The firmware version number (the version number is displayed with the sign-on message of the TNC.)

If possible, you should have the TNC and your computer available to perform troubleshooting operations when you call.

The Service Department telephone hours are 9 am - noon and 2 pm - 5 pm Central Time 913-842-4476, Monday through Friday.

When writing, include a clear description of the problem, unit name, computer type, computer software used and if possible a DISPLAY listing from the TNC.

Returns to the factory for refund or exchange are strictly regulated. Any return for refund or exchange must be approved by the service department.

Radio Frequency Interference Statement

This equipment complies with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of the FCC rules. These specifications are designed to minimize radio frequency interference in a residential installation; however, there is no guarantee that radio or television interference will not occur in any particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on when the radio or television is on, the user is encouraged to try to correct the interference by one of the following measures.

- Reorient the radio or TV receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that the computer and the receiver are on different branch circuits.

If necessary the user should contact the dealer or an experienced radio/TV technician for additional suggestions. The user may find the following booklet prepared by the FCC helpful:

How to Identify and Resolve Radio-TV Interference Problems.

This booklet is available from the U.S. Government Printing Office, Washington, D.C., 20402 by ordering Stock No. 004-00000345-4.

RFI Suppression

In moving to the world of digital communications via computers, a new dimension of RFI may be encountered. In spite of the equipment manufacturers' diligence, each new piece of electronic equipment will react differently in each separate environment. Every amateur station will have its own unique layout, equipment variation, and antenna installations. Experience has shown that these differences are related to the total RF environment, and may be causative factors in RFI induced problems. The suggestions given here may assist in resolving RFI problems you may encounter in your "unique" station.

1. Use shielded cable for all connections between equipment.

2. Make all interconnecting cables as short as practical. A balance should be maintained between cable length and equipment proximity. At times simply moving the video monitor one foot further from an interface or other device will solve the "screen hash" problem.

3. Antenna runs should be kept away from equipment control lines and/or interconnecting cables. If it is necessary for such lines to cross each other they should do so at 90 degree angles.

4. Ground leads should be as short as possible and go to a GOOD EARTH GROUND.

5. Interconnecting cables appearing to act as radiators or antennas should be looped through a toroid. Be certain toroids, if used, are designed for the frequency in use.

Precautions

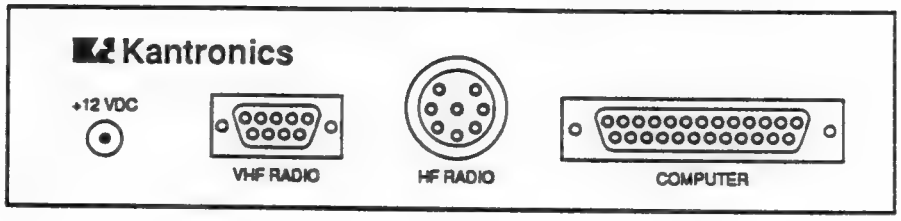
The TNC is grounded through its connections to your transceiver. Make sure your transceiver is properly grounded and your computer has equal ground potential. Follow the grounding instructions in your transceiver manual.

Cables provided with the TNC are shielded. If you decide to use other cabling, be certain it is also shielded. We do not recommend the use of unshielded RS-232 ribbon cable in the ham shack environment.

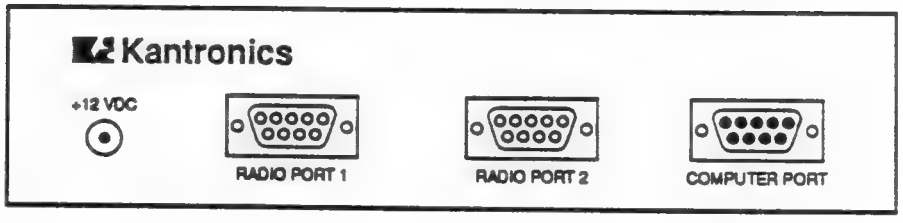
Pin 25 of the DB-25 connecter on the KAM, KPC-2, and KPC-2400 has 12 volts and should never be connected to your terminal or computer output port. Pin 18 in the KPC-2 is used by factory personnel only. Under no circumstances should you connect this pin to your terminal or computer output port.

Back Panels

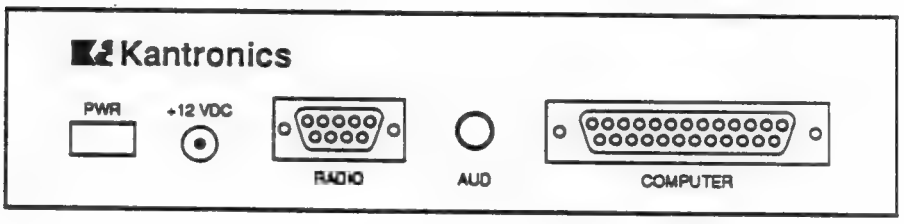
KAM



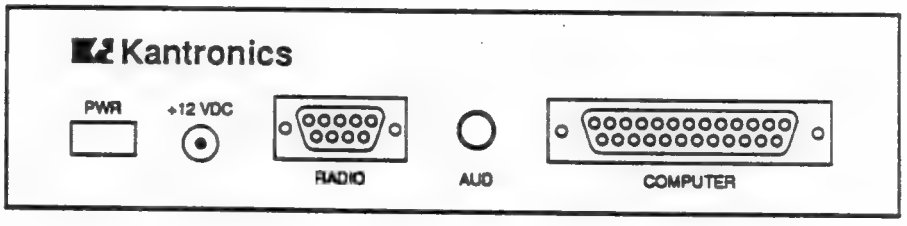
KPC-4



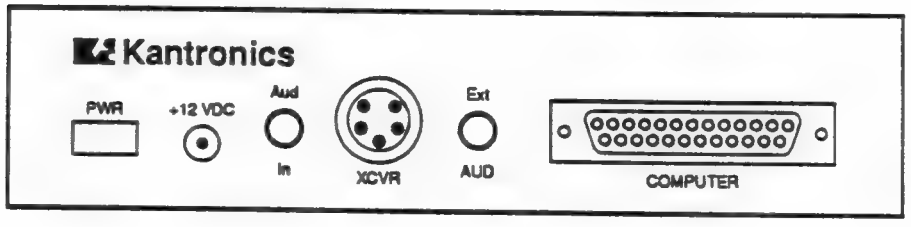
KPC-2



KPC-2400



KPC-1



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Connecting the TNC to Your Computer

RS-232/TTL Jumper

Jumpers are appropriately labeled on the PC board. Refer to the parts location diagram for help in locating them. Also refer to the Assembly and Disassembly section for information on obtaining access to the interior of the TNC.

KAM Jumper K7

KPC-4 Jumper K10

KPC-2 Jumper K2

KPC-2400 Jumper K2

KPC-1 Jumper K2

This jumper is provided to change the TNC from RS-232 to TTL operating voltage levels. All TNCs are shipped from the factory in the RS-232 position. If your computer operates at TTL level voltages, reposition this jumper prior to placing the TNC in service.

TNC to Computer Connection

The TNC is connected to the serial data port of your computer and a terminal program must be loaded into your computer. The serial port provides a place for data to be sent to or received from the TNC. The terminal program is the software which runs in the computer, allowing it to communicate with the TNC. This is also sometimes called a communications program.

A few computer systems include a terminal program on the systems diskette or in the initial software package, usually named COMM, TERM, or a similar name which conveys the idea of communicating. Some computer systems require that a terminal program be obtained separately. Several simple terminal programs have been included in the Sample Terminal Programs section to assist you. In general, any program which allows telephone modem communications with the computer will be suitable for use with the TNC. A special program will be needed for the display of Wefax pictures.

There are generally four variables to be set in your terminal program. These are baud rate, parity, word length (also called data bits) and the number of stop bits. If your terminal program provides for these variables, use the following settings to talk to the TNC:

Baud rate: 300, 600, 1200, 1800, 2400, 4800 or 9600

Parity: None

Data bits: 8

Stop bits: 1

The 25-pin connector on the back panel of the TNC is for connecting to the computer. (The KPC-4 has a 9-pin connector.) When facing the back of the TNC the connector on the right side is labeled COMPUTER. See page 5 for back panel diagrams.

Cable Wiring

A cable is provided with nine prewired lines for the connector. You must provide the connector to attach these lines to your computer serial port. In most cases, unless the terminal program you use requires hardware flow control, you need only connect three of these lines – Transmit Data, Receive Data and Signal Ground. For hardware flow control, also called RTS/CTS handshaking, five wires are required.

Since there are so many computers on the market, it is impossible to provide interfacing information on all of them. The following chart shows what pins are used in the TNC by name and number, and the corresponding pin to connect to for the most commonly used computer connectors. As a general rule, if you have a computer not covered here that has a serial data port, wire pins of the same name together. Limited information on some of the other common computers will follow.

Transmit Data (TXD), Receive Data (RXD) and Signal Ground (SG) must always be wired in order for the TNC and the computer to exchange any data. Many terminal programs also require the use of hardware flow control from the TNC. For hardware flow control Request To Send (RTS) and Clear To Send (CTS) must also be wired. Check the documentation to your terminal program to see if any other wires are required. DO NOT CONNECT ALL 25 WIRES.

Some programs want to see Data Set Ready (DSR) to know that the TNC is there before operating. If this is the case wire both DSR and Data Terminal Ready (DTR). Or sometimes you can satisfy the program's needs by jumpering these two pins at the computer end of the cable. Data Carrier Detect (DCD) is needed by some BBS software to know that a connection has taken place. This would require wiring DCD. Some phone modem programs also want to see a connection before allowing you to even talk to the TNC. This case can usually be solved by jumpering DCD to DTR at the computer end of the cable. If your computer requires DSR and also DCD, it is perfectly acceptable to jumper all three pins (DTR, DSR, and DCD) together on the computer end of the cable.

The TNC is wired as DCE (Data Communication Equipment). DCE equipment always sends its data on the RXD wire. DTE (Data Terminal Equipment) talks on TXD. This means that if a computer is wired internally as DCE and attached to the TNC it will need to have TXD from the computer wired to RXD on the TNC, and RXD from the computer wired to TXD of the TNC. Otherwise they will both be talking on the same wire and never hear what is said. If properly implemented by the DCE computer, hardware flow control may be used by connecting RTS from each device to CTS on the other device.

Caution: Make sure the power to the transceivers, computer, and TNC is OFF before connecting any cables.

DB-25 Connector

Male (Looking at Pins)

Female (Looking at Holes)

DB-9 Connector

Male (Looking at Pins)

Female (Looking at Holes)

Pin Name	TNC (DCE) DB-25 Pin No.	DB-9 Pin No.	Prewired Cable Color	direction	RS-232 Computer (DTE) DB-25	DB-9
FG*	1	N/A	black	====	1	N/A
TXD	2	3	white	<===	2	3
RXD	3	2	red	===>	3	2
SG*	7	5	orange	====	7	5
RTS	4	7	green	<===	4	7
CTS	5	8	brown	===>	5	8
DCD	8	1	yellow	===>	8	1
DSR	6	6	blue	===>	6	6
DTR	20	4	purple	<===	20	4
mark	11	(KAM) To external scope, if desired				
space	18	(KAM) To external scope, if desired				
test	18	(KPC-2) DO NOT CONNECT TO COMPUTER				
+12V	25	DO NOT CONNECT TO COMPUTER				

* FG (Frame Ground) and SG (Signal Ground) are tied together in the TNC. The shield is on pin 1 of the DB-25 and on pin 5 of the DB-9. The black wire is not connected in the KPC-4 serial cable.

The functions of these lines are explained below.

DB-25 Pin 2 **TXD** DB-9 Pin 3

Transmit Data. This line is the serial data from the terminal which is to be transmitted to the other station by the TNC. It is this line which is used for all communication from your terminal to the TNC, including commands.

DB-25 Pin 3 **RXD** DB-9 Pin 2

Receive Data. This line is used by the TNC to send the data it receives from the other station to your terminal. This line is also used to send TNC messages to your terminal.

DB-25 Pin 7 and 1 **SG** DB-9 Pin 5

Signal Ground. This line establishes the common reference potential for all circuits except Protective Ground.

DB-25 Pin 4 **RTS** DB-9 Pin 7

Request To Send. This line tells the TNC that the terminal is ready to receive data. An ON level tells the TNC it may send data while an OFF level tells it to stop sending data. If the terminal for any reason is unable to accept data from the TNC, it will cause this line to change to an OFF state, providing that the terminal supports hardware flow control. For instance, buffer is full, terminal is turned off, and so on.

DB-25 Pin 5 **CTS** DB-9 Pin 8

Clear To Send. This line is used by the TNC to tell the terminal whether or not it may send data to the TNC. An ON level tells the terminal it may send data while an OFF level tells it to stop sending data. This pin is the complement to the RTS pin, implementing hardware flow control in the other direction.

DB-25 Pin 8 **DCD** DB-9 Pin 1

Data Carrier Detect. This line is an output from the TNC indicating connected status of the TNC. When a connection exists on the current stream, this line will be true. (When using TTL levels, DCD at +5 volts indicates connected status.) This pin has no function in the KPC-1.

DB-25 Pin 6 **DSR** DB-9 Pin 6

Data Set Ready. Some terminal programs look at this pin to see that the TNC is operating before allowing you to talk to the TNC. This pin is pulled true and is common with DTR, as shipped from the factory. In the KPC-1 DSR is jumpered to DTR and is not connected to any internal circuitry.

DB-25 Pin 20 **DTR** DB-9 Pin 4

Data Terminal Ready. This pin is common with DSR in the TNC. The TNC assumes the terminal is operating and does not require the terminal to pull this pin true. This pin may be isolated from DSR if desired. In the KPC-1 DTR is jumpered to DSR and is not connected to any internal circuitry.

DB-25 Pins 11/18 **Mark/Space**

KAM ONLY

Mark/Space. These signals are available for connecting an external scope if desired. Refer to the Scope Monitoring section for instructions.

DB-25 Pin 18 **Test**

KPC-2 ONLY

Processor Test Input. This is used by factory personnel only in repair and service operations. UNDER NO CIRCUMSTANCES should you connect this pin to your terminal or computer output port.

DB-25 Pin 25 **Plus 12 Volts**

KAM, KPC-2 and KPC-2400

+12V. This is an alternate input pin for supplying power to the TNC if desired. If the normal +12 VDC input jack is used, this pin will be HOT. BE CERTAIN THIS PIN IS NOT CONNECTED TO YOUR COMPUTER.

Other Common Computers

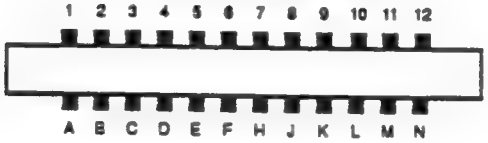
If you have a C-64, C-128, VIC-20, PCjr, Radio Shack Color Computer, TRS Model 100, or an Atari 850, some limited information follows. For a description of the functions of the TNC pins refer to the previous information.

Commodore C-64, C-128 or VIC-20

If you are using an RS-232 adapter follow the previous instructions for Cable Wiring. If you are not using an RS-232 adapter, remember to change the TNC's RS-232/TTL Internal Jumper from RS-232 to TTL (see beginning of this chapter). Many programs will only require TXD, RXD and SG. If using hardware flow control RTS and CTS will also be required.

Commodore User Port

24 pin Double-Sided
Card Edge Connector



Looking at Back of computer or
Back (wiring side) of connector

Pin Name	TNC (DCE) DB-25 Pin No.	DB-9 Pin No.	Prewired Cable Color	direction	Commodore User Port (TTL) Pin Id
TXD	2	3	white	<===	M
RXD	3	2	red	===>	B & C
SG	7/1	5	orange	====	N
RTS	4	7	green	<===	D
CTS	5	8	brown	===>	K
DCD	8	1	yellow	===>	H
DSR	6	6	blue	===>	L
DTR	20	4	purple	<===	E
mark	11	(KAM) To external scope, if desired			
space	18	(KAM) To external scope, if desired			
test	18	(KPC-2) DO NOT CONNECT TO COMPUTER			
+12V	25	DO NOT CONNECT TO COMPUTER			

PCjr

The IBM PCjr has a built-in terminal program in the basic cartridge. The terminal mode is started by typing TERM. Consult the PCjr Technical Reference Manual for pin-out requirements for the PCjr serial port. You will have to buy a special connector from your computer dealer for the PCjr.

Radio Shack Color Computers

The serial port of the color computer uses a 4-pin DIN plug. Pin connections at the port are shown in the pin table below.

Pin Name	TNC DB-25	KPC-4 DB-9	Cable Color	TRS CoCo
TXD	2	3	white	4
RXD	3	2	red	2
SG	7	5	orange	3

This is known as a three-wire interface and therefore requires the use of software flow control. This cabling supports the TRS VIDTEX program. If you have a micro-color computer, such as the MC-10, cabling is different; consult your computer reference manual.

You may also use the Radio Shack Deluxe RS-232 Program Pak. This is a plug-in module for the TRS-80 Color Computer line which is available from Radio Shack Stores.

The Deluxe RS-232 Pak has a standard DB-25 serial port connector to which you connect the TNC using the following pin configurations:

Pin Name	TNC DB-25	KPC-4 DB-9	Cable Color	TRS RS-232
TXD	2	3	white	2
RXD	3	2	red	3
SG	7	5	orange	7

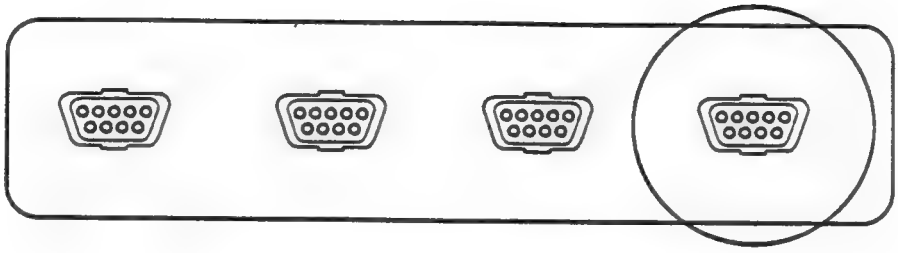
You must also install a jumper between pin 8 and pin 20 on the DB-25 connector of the Deluxe RS-232 Pak. It is not necessary to connect RTS/CTS lines. Since these lines are not connected, you must use software flow control. Configure the Deluxe RS-232 Pak as outlined in its operation manual, select the Terminal Mode and you will be ready for packet operation.

TRS Model-100

This computer has a standard RS-232 serial port using a DB-25 connector wired as DTE. The internal modem program DOES NOT support CTS/RTS hardware flow control. Be sure to have the TNC command XFLOW ON so that software flow control (XON/XOFF) will be used. You should make a three-wire cable as follows:

Pin Name	TNC DB-25	KPC-4 DB-9	Cable Color	TRS-100
TXD	2	3	white	2
RXD	3	2	red	3
SG	7	5	orange	7

Atari 850 Interface



Looking at socket from outside of Interface

Pin functions of Serial Port No. 1 in 850 Interface Module 9-pin female connector:

Pin Name	TNC DB-25	KPC-4 DB-9	Cable Color	Atari 850 Interface
TXD	2	3	white	3
RXD	3	2	red	4
SG	7	5	orange	5
RTS	4	7	green	7
CTS	5	8	brown	8

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Connecting Your Radios

The TNC is attached to your transceiver(s) via the radio connector(s) on the back panel. (See page 5 for back panel diagrams.) The KPC-2 and KPC-2400 each have one DB-9 connecter labeled RADIO, which is used for either VHF or HF. The KPC-1 has one 5-pin din connector labeled RADIO, which is used for either VHF or HF. The KAM has a DB-9 connector labeled VHF RADIO and an 8-pin din connector labeled HF RADIO. The KPC-4 has two DB-9 connectors for VHF/UHF radio connections labeled PORT 1 and PORT 2.

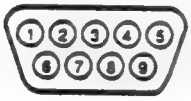
Prewired cables are provided with the appropriate connector for the TNC port. Two cables come out of the connector. One with a speaker plug attached, to be plugged into the transceiver's external speaker jack. You will need to provide the mic-jack connector for your transceiver and wire the connector to the other cable. Lines from this connector are used to control the PTT function of the transceiver, input AFSK tones from the TNC, and provide other alternate Inputs/Outputs as described. The KPC-1 comes with two separate cables. One for audio with speaker plugs on both ends. The other cable has a 5-pin din connector on the end for the KPC-1, and you will need to provide the mic-jack connecter for your transceiver and wire it to the other end of this cable.

Some radios may require adjustment of the AFSK Output Levels or Equalization of the received signals. See the AFSK Output Level and Calibration/Equalization sections for information.

Caution: Check your transceiver manual to correctly wire the corresponding pins of the transceiver mic-jack.

DB-9 Radio Connector

DB-9 Connector



Male (Looking at Pins)

Female (Looking at Holes)

Pins 1, 3, 5 and 6 must be connected to your radio.

Pin 1 – AFSK Out – white lead. This line carries the AFSK tones generated by the TNC to the Audio Input (microphone) line of your transceiver. If your transceiver provides a DC voltage on its microphone input, you must isolate this voltage from the TNC. This is normally true for hand-held radios. (See the Interfacing Hand-Held Radios section.)

Pin 2 – XCD – yellow lead. This line may be used to connect the squelch line from your VHF transceiver if desired. This connection will not normally be required, nor used, unless operating on a shared voice channel. Normally the TNC detects other signals by using its internal software to determine if data is present. If this pin is connected, a ground potential on this pin will tell the TNC that a signal is present (even if there is no data) and therefore prevent the TNC from transmitting until the signal is no longer present. (See the CD parameter in the Commands Manual.)

BR Pin 3 – Push-To-Talk – brown lead. This line controls the PTT line in your transceiver, allowing the computer to switch the transceiver from/to transmit or receive. Connect directly to the PTT line of the mic-jack connector. (See the section on Interfacing Hand-Held Radios for special notes concerning this pin.)

BLUE Pin 4 – Blue lead – KAM same as pin 5.

KPC-4, both ports, same as pin 5.

KPC-2 same as pin 6.

KPC-2400 has no connection.

PU Pin 5 – Audio Signal – 2 conductor audio cable, center conductor and 9-wire cable, purple conductor. This line is prewired for your use as the audio input from your transceiver external speaker jack. Do not use a headphone output from the transceiver. If you use an accessory or phone patch output, it may be necessary to provide a padding network to reduce amplitude of the signal being fed to the TNC. High level fixed outputs may have a tendency to "swamp" the TNC input circuits. Fixed output signals in excess of 50 mV should be padded.

For the KAM and KPC-4 you can plug this lead into one leg of the Y-connector cable provided in the TNC accessory bag. Plug the Y-connector cable into the external speaker jack of the transceiver. The remaining female connector on the Y-connector cable may be used for an external speaker. For the KPC-2 and KPC-2400 the audio jack on the back panel remains available for attachment of an external speaker.

SH Pin 6 – Ground/Shield – shield of 9-wire cable and shield of audio cable. Connect the push-to-talk ground and AFSK shield to this line. With some transceivers which do not reference PTT and audio shielding to a common ground, it may be necessary to leave the AFSK shield (braided wire) disconnected. Note: All TNC grounds are common.

Pin 7 – KPC-4 Radio Port 1 External Reset – red lead. An external reset line is provided on this pin. Applying a ground, either from a local or remote source is the same as turning on the TNC. This is only on the KPC-4 Radio Port 1.

RED Pin 7 – +12VDC in – red lead. This lead is provided as an alternate power input. It may be used in place of the +12 VDC jack. If you do not plan to use this alternate input you should clip the wire and insulate it. This lead will be HOT whenever the TNC is powered. This connection should not be used to power any accessory device. Note that on the KPC-4, Radio Port 2 has +12 volts on this pin whereas Radio Port 1 does not. DO NOT INTERCHANGE CABLES CONNECTED TO THE KPC-4 if you are using this pin on either port.

Pin 8 – Green lead – KAM same as pin 6.

KPC-4 both ports, same as pin 6.

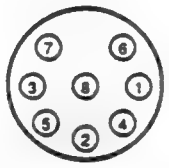
KPC-2 no connection.

KPC-2400 no connection.

Pin 9 – Ground – Black lead – same as pin 6.

8-Pin Din Radio Connector (KAM HF)

8-Pin Din



Female (Looking at Holes)

Pins 1, 2, 3 and 6 must be connected to your radio.

Pin 1 – AFSK Out – white lead. This line carries the AFSK tones generated by the KAM to the Audio Input (microphone) line of your transceiver.

Pin 2 – Ground/Shield – black and shield of 9-wire cable and shield of audio cable. Connect the push-to-talk ground and AFSK shield to this line. With some transceivers which do not reference PTT and audio shielding to a common ground, it may be necessary to leave the AFSK shield (braided wire) disconnected. Note: All TNC grounds are common.

Pin 3 – Push-To-Talk – brown lead. This line controls the PTT line in your transceiver allowing the computer to switch the transceiver from/to transmit or receive. Connect directly to the PTT line of the mic-jack connector.

Pin 4 – Key Out – orange lead. This line may be used to control CW keying on your transceiver. Separate a small length of this lead and attach a lead with the appropriate plug for your transceiver key jack, where you would normally connect a straight key.

Pin 5 – FSK Out – red lead. This line is for use if your transceiver provides FSK keying for radioteletype operation. Separate a small length of this lead and attach a lead with the appropriate plug for your FSK input connector on the transceiver. It will also be necessary to provide for PTT keying via the mic jack, accessory port or other method specified by your transceiver manual.

Pin 6 – Audio Signal – 2 conductor audio cable, center conductor and 9-wire cable, purple conductor. Plug this lead to one leg of the Y-connector cable provided in the KAM accessory bag. Plug the Y-connector cable into the external speaker jack of the transceiver. The remaining female connector on the Y-connector cable may be used for an external speaker. Do not use a headphone output from the transceiver. If you use an accessory or phone patch output, it may be necessary to provide a padding network to reduce amplitude of the signal being fed to the KAM. High level fixed outputs may have a tendency to "swamp" the KAM input circuits. Fixed output signals in excess of 50 mV should be padded.

Pin 7 – Blue lead – This pin is not connected in the KAM but the blue conductor of the 9-wire cable is attached to this pin.

Pin 8 – XCD – yellow lead. This line may be used to connect the squelch line from your HF transceiver if desired. This connection will not normally be required, nor used, unless operating on a shared voice channel. (See the CD parameter in the Commands Manual.)

5-Pin Din Radio Connector (KPC-1 – Packet Communicator)

5-Pin Din

Female (Looking at Holes)

Pins 1, 2, 3, and Audio In must be connected to your radio.

Pin 1 – AFSK Out – white lead. This line carries the AFSK tones generated by the TNC to the Audio Input (microphone) line of your transceiver. If your transceiver provides a DC voltage on its microphone input, you must isolate this voltage from the TNC. This is normally true for hand-held radios. (See the Interfacing Hand-Held Radios section.)

Pin 2 – Ground/Shield – black and stranded lead. Connect the push-to-talk ground and AFSK shield to this line. With some transceivers which do not reference PTT and audio shielding to a common ground, it may be necessary to leave the AFSK shield (braided wire) disconnected. Note: All TNC grounds are common.

Pin 3 – Push-To-Talk – Brown lead. This line controls the PTT line in your transceiver allowing the TNC to switch the transceiver from/to transmit or receive. Connect directly to the PTT line of the mic-jack connector. (See the section on Interfacing Hand-Held Radios for special notes concerning this pin.)

Audio in – Attach a cable from the external speaker jack of the transceiver to the Audio In jack on the rear panel of the Packet Communicator. Do not use a headphone or phone patch output from your transceiver.

External Speaker Jack – This jack can be used to loop the audio through the Packet Communicator. Use a 3.5 mm plug and shielded audio cable to connect to an external speaker.

AFSK Output Level

Audio Frequency Shift Keying

Jumpers are appropriately labeled on the PC board. Refer to the parts location diagram for help in locating them. Also refer to the Assembly and Disassembly section for information on obtaining access to the interior of the TNC.

KAM – AFSK Output – VHF – Jumper K2

This jumper is provided to alter the VHF AFSK output level. The KAM is shipped from the factory with the jumper in the LO position. The LO position sets an AFSK output level from the KAM at 10 mV. The HI position sets an AFSK output level of 50 mV. Both levels are peak-to-peak values. In general, transceivers requiring a pre-amplified microphone will also require the HI level AFSK output from the KAM. Removing the jumper entirely will provide the maximum possible output level of approximately 1.7 P/P volts VHF. Should you require an intermediate value of AFSK modulation signal, it may be obtained by replacing resistor R12 with the appropriate value chosen from the following chart. If you change R12 to obtain an intermediate value, place K2 in the HIGH position.

R12 Value	AFSK Output Level
470 ohms	24 mV
2.2 Kohms	106 mV
6.8 Kohms	290 mV
22 Kohms	680 mV
47 Kohms	1000 mV

KAM – AFSK Output – HF – Jumper K5

This jumper is provided to alter the HF AFSK output level. The KAM is shipped from the factory with the jumper in the LO position. The LO position sets an AFSK output of 100 mV. The HI position sets the output level at 500 mV. Both levels are peak-to-peak values. In general, transceivers requiring a pre-amplified microphone will also require the HI level AFSK output from the KAM. Removing the jumper entirely will provide the maximum possible output level of approximately 1.6 volts P/P. Should you require an intermediate value of AFSK modulation signal, it may be obtained by replacing resistor R25 with the appropriate value chosen from the following chart. If you change R25 to obtain an intermediate level, place K5 in the HIGH position.

R25 Value	AFSK Output Level
680 ohms	48 mV
3.3 Kohms	209 mV
4.7 Kohms	282 mV
6.8 Kohms	377 mV
22 Kohm	800 mV

KPC-4 – AFSK Output – Jumpers K3 and K4

These jumpers are provided to alter the AFSK output level. The KPC-4 is shipped from the factory with the jumpers in the LO position. The LO position sets an AFSK output level from the KPC-4 at 10 mV. The HI position sets an AFSK output level of 50 mV. Both levels are peak-to-peak values. In general, transceivers requiring a pre-amplified microphone will also require the HI level AFSK output from the KPC-4. Removing the jumper entirely will provide the maximum possible output level of approximately 1.7 volts. Should you require an intermediate value of AFSK modulation signal, it may be obtained by replacing resistor R23 or R29 with the appropriate value chosen from the following chart. If you change resistors to obtain an intermediate value, place the appropriate jumper in the HIGH position.

K3	K4	
R23 Value	**R29 Value**	**AFSK Output Level**
470 ohms	470 ohms	24 mV
2.2 Kohms	2.2 Kohms	106 mV
6.8 Kohms	6.8 Kohms	290 mV
22 Kohms	22 Kohms	680 mV
47 Kohms	47 Kohms	1000 mV

KPC-2 – AFSK Output – Jumper K1
KPC-1 – AFSK Output – Jumper K3

This jumper is provided to alter the AFSK output level. The TNC is shipped with this jumper in the high position. In the high position output level is 21 mV P/P. In the low position output is 4.5 mV P/P. If a higher output level is required for your radio it may be obtained by changing the resistor (R14 in KPC-2, R37 in KPC-1). The chart below gives the output levels for different values of the resistor with the jumper in the HI position.

KPC-2 R14 value	KPC-1 R37 value	AFSK level
100 ohm	100 ohm	4.5 mV
220 ohm	220 ohm	10 mV
470 ohm	470 ohm	21 mV
1 K	1 K	44 mV
1.5 K	1.5 K	65 mV
2.2 K	2.2 K	94 mV
8.2 K	8.2 K	298 mV

Should you require a still higher AFSK output level the value of the resistor may be increased further to provide incremental increases in the same approximate ratio as that shown in the table. For maximum output level the HI LO jumper can be removed entirely. In this case AFSK output level will be approximately 1.5 volts peak-to-peak.

KPC-2400 – AFSK Output – Jumper K1

This jumper is provided to alter the AFSK output level. The KPC-2400 is shipped with this jumper in the high position. In the high position output level is 44 mV P/P (open circuit, 600 ohms nominal). In the low position output is 10 mV P/P. If a higher output level is required for your radio it may be obtained by changing R32. The chart below gives the output levels (open circuit) for different values of R32 with the jumper in the HI position.

R32 value	AFSK level
100 ohm	4.5 mV
220 ohm	10 mV
470 ohm	21 mV
1 K	44 mV
1.5 K	65 mV
2.2 K	94 mV
8.2 K	298 mV

Should you require a still higher AFSK output level the value of R32 may be increased further to provide incremental increases in the same approximate ratio as that shown in the table. For maximum output level the HI LO jumper can be removed entirely. In this case AFSK output level will be approximately 1.5 volts peak-to-peak.

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Interfacing Hand-Held Radios

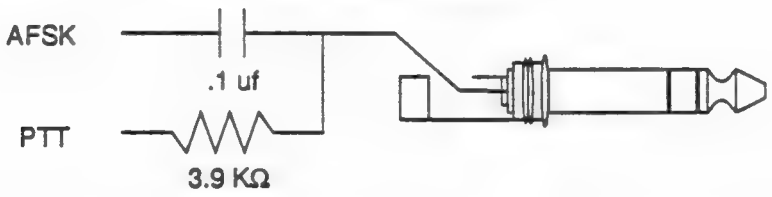
Many transceivers, especially most hand-held models, obtain Push-To-Talk keying by completing a circuit between the mic input and PTT ground. A direct PTT input to the mic input line of units with this type electret condenser microphone is not usable without some type of isolation.

If you plan to operate with a hand-held transceiver, the KAM, KPC-2 and KPC-4 have incorporated an isolation circuit which is available by jumper positioning. Should you later use a different type radio, this change may need to be reconfigured. Most other radios of current manufacture will not require any modification of the TNC.

You may also interface to a hand-held without performing this modification by incorporating the same type of circuitry in the cable from your TNC to your hand-held. Ground return and speaker audio are both supplied thru the external speaker jack of your hand-held.

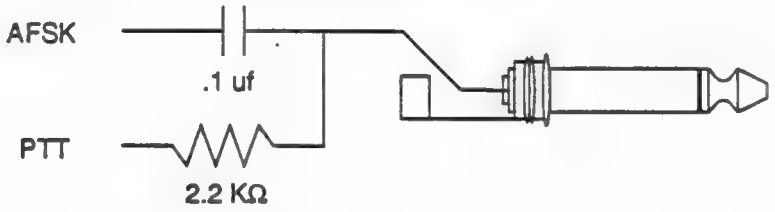
ICOM HT radios key the PTT by providing a low impedance path from the mic input to ground. To accomplish this, simply install a resistor (approximately 3.9K seems to be a good value) in series with the PTT wire from the TNC, and connect this to the mic input along with the AFSK line.

Icom Mic Connector



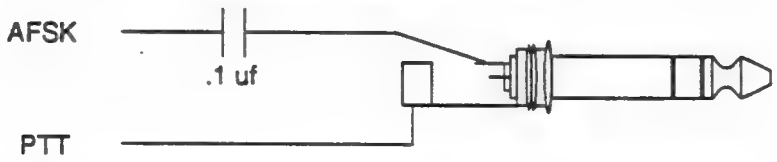
Yaesu radios are similar but use a mono plug and a different resistor.

Yaesu Mic Connector



Most KENWOOD HT radios key the PTT line by connecting the sleeve of the mic connector to the sleeve of the earpiece connector. This means that you will not need a resistor in the PTT wire from the TNC, simply connect the PTT wire to the sleeve of the mic connector. Another point to watch – most of the KENWOOD HTs (2500 and later) use a three pin mic connector. The AFSK from the TNC should therefore connect to the RING and not the TIP of the mic connector.

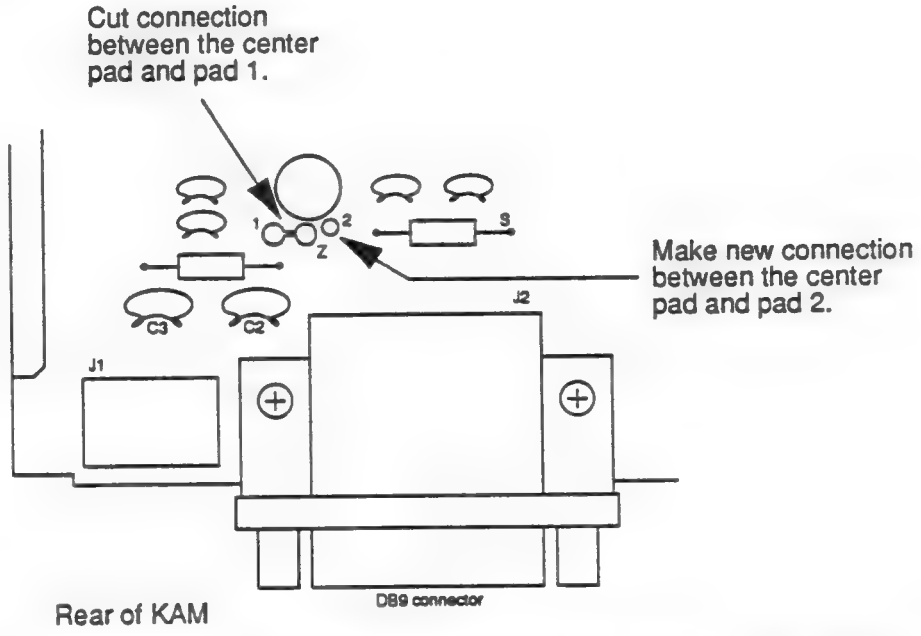
Kenwood Mic Connector



Enabling the Isolation Circuit in the KAM

1. Refer to the Assembly and Disassembly section for instructions if necessary and remove the KAM from its case.

2. Locate point Z on the PC board. This point is at the rear, near the HF radio output port and power jack.



3. Locate the three pads associated with Z. Note that the center pad and the pad marked 1 is larger than the pad marked 2.

4. Carefully cut the connection between the center pad and pad 1.

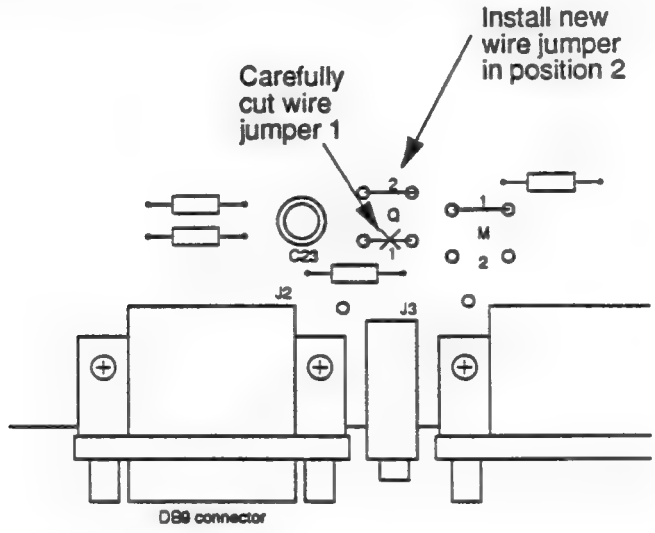
5. Make a new connection between the center pad and pad 2. You may wish to make this connection on the bottom of the PC board instead of the component side.

6. Connect the AFSK and PTT lines together.

Enabling the Isolation Circuit in the KPC-2

1. Refer to the Assembly and Disassembly section for instructions if necessary and remove the KPC-2 from its case.

2. Locate jumper Q on the PC board. This location is at the rear of the PC board.



Rear of KPC-2

3. Locate the wire jumper marked 1.

4. Carefully cut the jumper.

5. Install a new jumper in position 2. You may wish to make this connection on the bottom of the PC board instead of the component side.

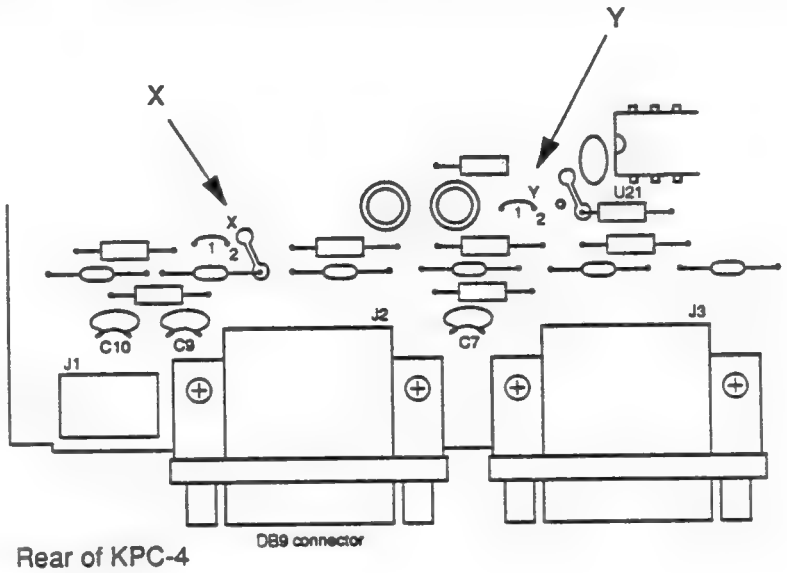
6. Connect the AFSK and PTT lines together.

Enabling the Isolation Circuit in the KPC-4

Separate circuits are provided for each radio port. Jumper X is for Port 1, Jumper Y is for Port 2.

1. Refer to the Assembly and Disassembly section for instructions if necessary and remove the KPC-4 from its case.

2. Locate point X or Y on the PC board. This location is at the rear of the PC board.



Rear of KPC-4

3. Locate the three points associated with X or Y. Note that there is a jumper at each of these locations which is in position 1.

4. Carefully cut the jumper.

5. Install a new jumper in position 2. You may wish to make this connection on the bottom of the PC board instead of the component side.

6. Connect the AFSK and PTT lines together.

In Case of Difficulty

Kantronics TNCs are manufactured to very stringent quality standards. If you have followed the installation procedures outlined in this manual, it is highly unlikely that you will encounter a failure. If you do have difficulty, use the procedures described in this section to assist in isolating and correcting the problem.

TNC Does Not "Sign-On" to Computer

1. Carefully recheck cabling between your computer serial port and the TNC.

2. Check carefully to insure that the Transmit Data, Receive Data, and Ground leads are connected to the proper pins.

3. If you have made a 5 wire connection to the computer serial port, change to a 3 wire connection.

4. Check your terminal program to be certain it is booted with the correct communications parameters (serial port, baud rate, parity).

5. Check to insure that the RS-232/TTL jumper is properly positioned for your computer.

6. Try a "Hard Reset" using the Test/Normal jumper. (Operate your terminal program at 300 baud when performing a hard reset.)

You Are Unable to Make a "Connect"

1. Issue a connect request and observe the XMIT LEDs. If an XMIT LED illuminates, check to insure that the radio is connected to the corresponding radio port.

2. Observe the radio to determine if it is being switched to the "Transmit" condition. If not, recheck wiring between the TNC radio port, PTT pin, and ground on the microphone jack.

3. Turn the VHF radio squelch control to "OFF" and see if the RCV LED illuminates on the packet controller. If it does not light, recheck the audio connection between your transceiver and the TNC.

4. If possible, monitor your transmitted signal with another radio. If the transmitter is keying to "Transmit" but weak or no audio is monitored, increase AFSK output as necessary using the AFSK Output jumper or a resistor change. (See the AFSK Output Level section.)

Cannot Transmit on Any Port

1. Check the 8BITCONV command. Many dumb terminals, and some Commodore programs, will not operate properly with this command turned ON. The symptoms most common for this problem are that everything seems to work fine in Command Mode, but upon entering Convers Mode, the TNC no longer seems to operate at all. Usually you cannot return to Command Mode with a Ctrl-C, pressing return does not send a packet, and it just seems like the serial cable between your computer and TNC has been unplugged.

2. Check your PARITY setting in the computer and in the TNC. These must match or else the computer may not really be sending the SENDPAC character ($0D) to the TNC.

Cannot Return to Command Mode

1. The single most common cause of this is that the STOP character (and usually XOFF) have been inadvertently set to the same as the COMMAND character. This is usually caused by the use of the dollar sign ($) as a streamswitch. If you use the $, be aware that you cannot enter hex values without PASSing the dollar sign. Symptoms for this usually are that you can talk to the TNC fine in Command Mode, you can usually talk to others on the air, but you just can't get back to Command Mode. (In non-packet modes, you will find that you cannot enter any of the special Ctrl-C directives either!) With most PC terminal programs, pressing Ctrl-C will display the heart character, but you still don't get the cmd: prompt.

Kanterm Program Problems

1. The most common problems reported with the Kanterm program result from not performing the Set Parameters option from within the program. This usually occurs after upgrading your TNC to a new version of the Kantronics firmware. The cause for this is the need to do a Hard Reset after installing the new firmware, and as a result, the TNC and your Kanterm program are no longer "in sync" with each other.

2. Commodore users will normally experience this problem when first setting the TNC up with their Kanterm software. All lower case characters are hidden, only numbers and punctuation appear. Typically, this means that when you first enter your callsign, only the number appears. In reality, the TNC did receive the proper callsign, and you can correct your display by choosing the Set Parameters option from the Miscellaneous Menu.

TNC Won't Transmit on HF – VHF is OK

This problem usually is a result of attempting to switch from one port to the other by using the PORT command. The PORT command only determines which port will be the default when the TNC is first turned on, or after a reset. In order to switch from one port to the other for transmitting data, you must use the STREAMSW characters as described in Multi-Connects in the Packet section of the Operations Manual.

Assembly and Disassembly of the TNC

Should you require access to the TNC to reposition jumpers or for other purposes, disassemble as follows:

1. Turn off power to your TNC and remove all cables from the unit.

2. Using a small phillips screwdriver, remove the two front panel screws just far enough to free the panel and bezel.

3. Carefully remove the front panel and bezel.

4. Note the screw holding the voltage regulator to the metal case. Remove this screw. (Does not apply to KPC-4.)

5. Slide the PC board out of the case.

To reassemble, reverse the procedure above. Be sure to re-install the screw holding the voltage regulator to the case (not in KPC-4). Failure to do so will damage the unit as the case provides a heat sink for the voltage regulator during normal operation. Do not attach cables to the rear of the TNC without supporting the front of the PC board or having the front panel secured in place. Doing so may break the voltage regulator secured to the front of the case.

Hard Reset

The hard reset process is provided to re-initialize the TNC to its default values. This process may become necessary should operational problems be encountered or when upgrading your firmware to a new version. The readout specified in step 5 below will be legible only if your terminal baud rate is 300. At other terminal baud rates, a reset will occur. However, no display readout will be observed. This procedure is performed as follows:

1) Remove the PC board from the case as outlined in the Assembly and Disassembly section, above.

2) Locate the Test/Normal jumper which is labeled NOR T (normal-test). Jumpers are appropriately labeled on the PC board. Refer to the parts location diagram for help in locating them.

KAM Jumper K6

KPC-4 Jumper K7

KPC-2 Jumper K3

KPC-2400 Jumper K3

KPC-1 Jumper K1

3) Place the jumper in the test position.

4) Apply power to the TNC.

5) Observe on the computer display (your terminal program must be set at 300 baud):

EEPROM INIT OK

CHECKSUM OK

RAM OK XXXXX BYTES

REPLACE TEST JUMPER

Some TNCs will not display the REPLACE message.

If you have removed the 2404 EEPROM from your unit for any reason, the EEPROM INIT message will read:

EEPROM INIT ERROR

This is a normal indication and does not indicate a failure with your TNC.

6) Turn power off. Do not keep the TNC power on for more than a minute or the regulator will overheat.

7) Return Test/Normal jumper to the normal position.

8) Reassemble the TNC and return to operation.

Calibration/Equalization

The CALIBRATE command is used to assist the TNC operator in determining the need for equalization of a received signal. Since this feature is unique to Kantronics TNCs, two stations using Kantronics TNCs are necessary to utilize this command.

KAM you must have your current I/O stream on the VHF radio port.

KPC-4 uses current I/O port (will not work with an external modem).

KPC-2 The HF, HFT and CCITT commands should be OFF. Calibration is checked at 1200 baud only.

KPC-1 Tones are transmitted and received at the HBAUD setting and the frequency is specified by the HF and HFT command settings.

KPC-2400 Tones are transmitted and received at the HBAUD setting and the frequency is specified by the HF, HFT, and CCITT command settings. However calibration cannot be done at the HBAUD setting of 2400.

Once the CALIBRATE command is given, three options will appear on the terminal screen:

Calibrate Mode Press R,T, or X

Pressing X will return the TNC to the Command Mode.

Pressing T will transmit a square wave (space/mark) at the selected tones until a key is pressed.

Pressing R will measure a square wave received.

One station should be used to transmit the square wave, while the receiving station should measure and compare the space/mark square wave. The transmitting station should set the microphone level in the mid range.

Once the receiving TNC is placed in the CALIBRATE receive mode, two numbers will appear on the screen. The TNC is measuring the space/mark square wave generated by the transmitting station. For the best calibration of the receiving transceiver, set the radio tone controls so that the two given values are as close to equal as possible.

In most instances when the ratio of the numbers is within a 40/60 or 60/40 range, the packet station will function normally. A larger disparity in the tones may cause additional retries during packet operation. This ratio may be determined by the following formula:

(N1 * 100) / (N1 + N2) where N1 is the number to the left of the displayed slash, and N2 is to the right of the slash. For instance, if the TNC displays 1400/1800, the ratio can be determined by:

(1400 * 100) / (1400 + 1800) or 140000/3200 = 44

Since the total is 100, the ratio is then 44/56 and is within the 40/60 criteria.

KPC-1, KPC-2, and KPC-2400. If the ratio of the numbers exceeds 60/40, you should change the setting of the equalization command (EQUALIZE). Use the setting (ON or OFF) which results in the ratio closest to 50/50.

KAM and KPC-4. If the ratio of the numbers exceeds 60/40, you should reset the internal Equalization jumper(s) for partial equalization. If, with partial equalization these numbers are still outside the 60/40 ratio, set the Equalization jumper for NO equalization.

Jumpers are appropriately labeled on the PC board. Refer to the parts location diagram for help in locating them. Also refer to the Assembly and Disassembly section for information on obtaining access to the interior of the TNC.

KAM Jumper K1

VHF Equalization – This jumper is provided to alter the equalization characteristics of the VHF modem. The KAM is shipped with the jumper placed on ONLY ONE of the posts effectively "OFF" so that full equalization is in effect. With no jumper installed on the 3-pin header, full equalization is in effect. With the jumper connecting the center post and the post marked 1, there is no equalization. With the jumper connecting the center post and the post marked 2, partial equalization is in effect. Testing has shown that most VHF transceivers require that the input audio signal be fully equalized for best performance. Should you wish to operate the KAM in a hard wire packet line, no equalization should be in effect.

KPC-4 Jumpers K1 (Port 1) and K2 (Port 2)

Equalization – These jumpers are provided to alter the equalization characteristics of the modems. The KPC-4 is shipped with the jumper placed on ONLY ONE of the posts, effectively "OFF", so that full equalization is in effect. With no jumper installed on the 3-pin header, full equalization is in effect. With the jumper connecting the center post and the post marked 1, there is no equalization. With the jumper connecting the center post and the post marked 2, partial equalization is in effect. Testing has shown that most VHF/UHF transceivers require that the input audio signal be fully equalized for best performance. Should you wish to operate the KPC-4 in a hard wire packet line, no equalization should be in effect.

Watch Dog Timers

Jumpers are appropriately labeled on the PC board. Refer to the parts location diagram for help in locating them. Also refer to the Assembly and Disassembly section for information on obtaining access to the interior of the TNC.

KAM – VHF Timer – Jumper K3

This jumper is provided to disable the VHF watch dog timer. The timer is disabled if the jumper is installed. Time-out of the KAM will occur after approximately 2.5 minutes, un-keying the VHF PTT line. The KAM is shipped with the jumper not connecting the jumper posts; therefore, the timer is in effect.

KAM– HF Timer – Jumper K4

This jumper is provided to disable the HF watch dog timer. The timer is disabled if the jumper is installed. Time-out of the KAM will occur after approximately 2.5 minutes, un-keying the HF PTT line. The KAM is shipped with the jumper installed; therefore, the timer is not in effect.

KAM Operating Note

As shipped from the factory, the VHF watch dog timer is in effect and the HF watch dog timer is not. The HF timer is not enabled since it cannot distinguish between RTTY and Packet signals. Should you plan to operate a mode other than Packet the HF timer will limit your transmission time to approximately 2.5 minutes if it is enabled.

KPC-4 – Timers – Jumpers K5 (Port 1) and K6 (Port 2)

These jumpers are provided to disable the watch dog timers. The timer is disabled if the jumper is installed. Time-out of the KPC-4 will occur after approximately 2.5 minutes, un-keying the PTT line. The KPC-4 is shipped with the jumpers not connecting the jumper posts; therefore, the timers are in effect. Should you wish to have a SHORTER timer interval, it may be obtained by changing the appropriate resistor shown in the following chart.

K5 Port 1	K6 Port 2	Time Delay	Resistor Value
R43	R44	1.25 min	470 Kohm
R43	R44	.75 min	220 Kohm
R43	R44	.5 min	2.2 Mohm

KPC-2400

The KPC-2400 is shipped with the Optional Watch Dog circuit board installed. (This applies to units after serial number 73400. An optional circuit board may be ordered from Kantronics for units with serial numbers before 73400 and should be installed for digipeater or unattened operation.)

K1 jumper on both pins disables watch dog circuit.

If harness is unplugged from watch dog board a 2.2 K 5% 1/4 watt resistor MUST be inserted between pins 1 and 5 of wiring harness connector to allow normal operation. WARNING: A resistor larger than 1/4 watt will damage the connector.

PTT shut-off time is approximately 2 minutes.

KPC-1 and KPC-2

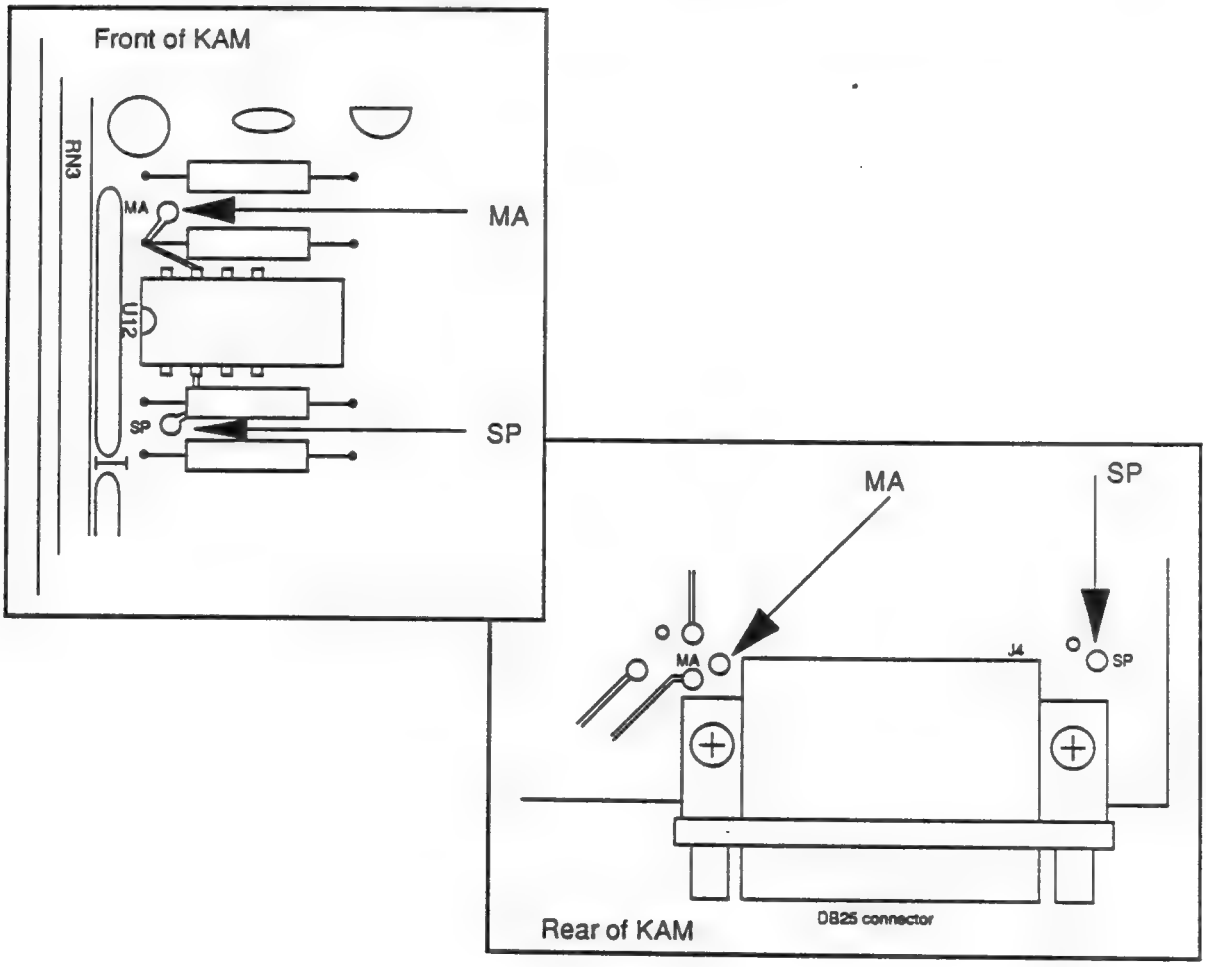
These TNCs do not come with a watch dog timer installed. An optional circuit board may be ordered from Kantronics and should be installed for digipeater or unattended operation.

Scope Monitoring

KAM Only

Obtaining Mark and Space Outputs

The schematic diagram of the KAM indicates that Mark and Space outputs are available on pins 11 and 18 of J4 (DB-25 connector) Provisions have been made for obtaining these outputs AFTER installing jumpers between the points provided on the PC board. This is accomplished by locating the four holes in the board marked MA and SP and adding wire jumpers between them. One pair of holes marked MA and SP are located next to the DB-25 connector (J4) and the other pair is located on the opposite end of the board. Install jumpers from MA to MA and SP to SP and Mark/Space signals will then be present at pins 11 and 18 of J4. It is advisable to install a 100 Kohm resistor in series with these lines to protect the KAM from external voltages.



Dumb Modem Mode

KPC-1, KPC-2 and KPC-2400 Only

The TNC can also be used as a straight-through or dumb modem. In this mode the TNC does not use any of the protocols or special characteristics of packet radio. Instead, the TNC simply outputs any information sent through the RS-232/TTL port, at up to 1200 baud.

To utilize the dumb modem feature, you must PERM the MODEMENA parameter ON. Hold the RTS line of the RS-232 connector at a negative voltage when the TNC is powered on. If the connector is set to the TTL level position, the RTS line must be held at a positive 5 volts when the TNC is powered on.

To operate in the dumb modem mode you must utilize the RTS and CTS lines. The TNC will function as a true RS-232 device, using these lines to control transmit and receive operation. The transmit and receive LED on the front panel will be operational. This mode uses the PERMed parameters as specified by the HF, HFT and CCITT command and checks the status of the EQUALIZE parameter.

To exit this mode you must turn the TNC off and power up with RTS free.

Performing a Loop-Back Test

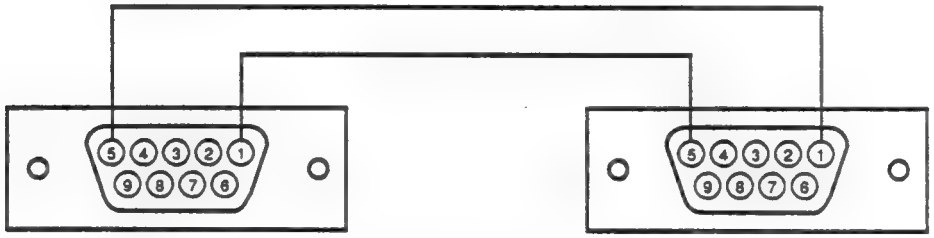
KPC-4 Only

This test is to verify that your KPC-4 is functional, and that the wiring to your computer is correct.

1. Remove the KPC-4 from its case. (See the Assembly and Disassembly section.)

2. Install jumpers between the radio ports as shown.

Female DB-9 Connectors (Looking at Holes)



3. Remove the header connectors from AFSK level jumpers K3 and K4.

4. Set a different callsign for Port 2. For example:

MYCALL WK5M/WK5M-9

5. At the CMD: prompt enter a connect request to the callsign you have set for Port 2. Your display should look like this:

CMD: C WK5M-9 (<CR>)

When you enter the carriage return the following will appear on your display:

CMD: ~A*** CONNECTED TO WK5M

|A*** CONNECTED TO WK5M-9

You are now in Convers Mode, connected to your Port 2. Type: HELLO <CR> and the following will be added to your display:

HELLO (you typed this for transmission on Port 1)

|AHELLO (this was received by Port 2)

6. You can manipulate transmission/reception between radio Port 1 and radio Port 2 by using the proper STREAMSW command, the ~ or |, or whatever streamswitch characters you have chosen.

7. These steps have shown that your KPC-4 is functional and that wiring to your computer is correct.

Modem Disconnect

KAM and KPC-4 only

Headers are appropriately labeled on the PC board. Refer to the parts location diagram for help in locating them. Also refer to the Assembly and Disassembly section for information on obtaining access to the interior of the TNC.

Headers K8 and K9

These connectors are provided for use with an external modem such as the KM-2400 modem (QPSK) or the MSK modem.

SWDETLED Modification

KPC-1 Only

To perform the Software Carrier Detect LED enable modification, (SWDETLED) remove the circuit board from the case as detailed in the Assembly and Disassembly section. Next, remove the 7910 IC (U-11) and bend pin 25 out slightly so that it will not make contact with the socket when the IC is re-inserted in U-11. Re-install the 7910 in socket U-11. With this modification completed, you will not detect ANY packets unless CD is set to SOFTWARE.

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Sample Terminal Programs

The following BASIC programs can be used to operate the Kantronics TNCs with the computers listed.

CAUTION: Each of the programs is a simple example of the necessary statements required to configure the computer for operation with an external device via the RS-232/TTL port. These simple terminal programs will NOT do file transfers or buffering of data and typing.

BASIC terminal program for the VIC-20/C-64

```
10 CLOSE2
20 OPEN2,2,3,CHR$(6)
30 GET#2,A$
40 REM
50 GET B$
55 IF B$=CHR$(133) THEN GOTO 100
60 IF B$<>""THEN PRINT#2,B$;
70 GET#2,C$
80 PRINT C$;
90 GOTO 50
100 CLOSE2
110 END
```

The #1 function key will return the C-64 computer to BASIC. If graphics characters appear, use the shift key with the Commodore key to change the character set. For use with the VIC-20, change the TNC COMMAND parameter to $05 (see Commands section of Commands Manual). Then a Ctrl-2 typed on the VIC-20 will return the TNC to the Command Mode. (The VIC-20 does not have a Ctrl-C command.)

This program uses a 3-wire cable as described in the Connecting Your Computer section. Wire only RXD, TXD and SG.

BASIC terminal program for the TRS-80 Model III

```
1 OUT 232,0
2 OUT232,164
3 OUT233,85
4 CLS
10 IF INP(234) and 128 then print CHR$(INP(235));:GOTO 10
20 A$=INKEY$:IF A$="" THEN 10
30 IF INP(234)and 64 THEN OUT 235,ASC(A$): GOTO 10 ELSE GOTO 30
```

Put the TRS-80 Model III in BASIC. Type and run the program. When the program is run the screen will go blank. At this time turn on the TNC. The TNC will send the PRESS * FOR AUTOBAUD routine.

This program uses a 3-wire cable as described in the Connecting Your Computer section. Wire only RXD, TXD and SG.

BASIC terminal program for the Apple computer with the Super Serial Card

```
10 REM THIS PROGRAM SETS UP THE SSC FOR THE TNC
20 REM ASSUMES THE SSC IS IN SLOT #2
30 A$=CHR$(1):D$=CHR$(4)
40 PRINT D$;"PR#2"
50 PRINT A$;"6 BAUD":REM SET 300 BAUD
60 PRINT A$;"0 DATA":REM 8 DATA, 1 STOP BIT
70 PRINT A$;"0 PARITY":REM NO PARITY
75 PRINT A$;"SD":REM DISABLE SPECIAL CHARS & ENABLE ESC KEY
80 PRINT A$;"TERM MODE"
90 REM IN TERMINAL MODE-TALK TO TNC
100 REM PRESS<CTRL RESET>TO EXIT PROGRAM
110 PRINT A$;"RESET"
120 END
```

BASIC terminal program for the Zenith Z-100

```
10 KEY OFF: CLS: CLOSE
20 OPEN"COM1:300,N,8,1" AS #1:
30 OPEN"SCRN:"FOR OUTPUT AS #2:
40 A$=INKEY$:IF A$=""THEN 60
50 PRINT #1,A$
60 IF LOC(1)=0 THEN 40
70 B$=INPUT$(LOC(1),#1)
80 PRINT #2,B$
90 GOTO 40
```

BASIC terminal program for the Atari 850 Interface

```
10 GOSUB 1600
20 FOR LOOP=0 TO 1 STEP 0
50 IF PEEK(764)=255 THEN 80
60 GET #KEY,A:IF A=126 THEN A=8
70 PUT #1,A
80 STATUS #1,A:BUF=PEEK(747)
90 IF BUF=0 THEN NEXT LOOP
100 FOR I=1 TO BUF
110 GET #1,A:IF A=8 THEN A=126
120 ?CHR$(A);:NEXT I
140 NEXT LOOP
1600 KEY=4
1610 XIO 36,#1,8,0,"R1:" :REM-300 BAUD
1630 XIO 34,#1,48,0,"R1:" :REM-RTS ON
1640 OPEN #1,13,0,"R1:"
1650 XIO 40,#1,0,0,"R1:"
1655 OPEN #KEY,4,0,"K:"
1660 RETURN
```

This program uses a 5-wire cable as described in the Connecting Your Computer section. When using this program, set the TNC's DELETE and AUTOLF commands to OFF.

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Specifications

KAM, KPC-4, KPC-2, KPC-2400, KPC-1

Size: KAM: 1-3/4" x 6" x 9"
KPC-4, KPC-2, KPC-2400, KPC-1: 1-3/4" x 6" x 8"

Weight: KAM: 2-1/2 lbs.
KPC-4, KPC-2, KPC-2400, KPC-1: 2-1/4 lbs.

Power Requirements:

KAM:	11 VDC to 14 VDC < 300 ma
KPC-4:	11 VDC to 14 VDC < 200 ma
KPC-2:	9 VDC to 14 VDC < 250 ma
KPC-2400:	10 VDC to 15 VDC < 330 ma
KPC-1:	10 VDC to 14 VDC < 330 ma

Power Plug Polarity: All units: Center pin positive

Watch Dog Timer: KAM, KPC-4, KPC-2400: ≈2-1/2 minutes
(Optional board for other units)

External Carrier Detect (XCD): KAM, KPC-4: Pulldown to ground

External Reset: KPC-4: Pulldown to ground

PTT Output: All units: Open collector, +40 VDC max

FSK Output: KAM HF: Open collector, +40VDC max

Key Output: KAM HF: Reed relay contact rated 0.5A and 300 VDC max
(100Ω series resistance)

Audio Output:	KAM HF	All Others
Output Drive:	100 mvpp (LO) 500 mvpp (HI) 1.6 vpp (no jump)	10 mvpp (LO) 50 mvpp (HI) 1.7 vpp (no jump) (does not apply to KPC-1)
Output Impedance: (ac coupled)	600 Ω	600 Ω

Audio Input:	KAM HF	All Others
Input Sensitivity:	20 mvpp (FM) 100 mvpp (AM)	20 mvpp
Dynamic Range:	>60 dB	>60 dB
Input Impedance: (unbalanced)	600 Ω	600 Ω
Max Input Voltage:	±12 VDC	±12 VDC

Modes of Operation:
KAM: Packet, CW, RTTY, ASCII, AMTOR (CCIR 476 and CCIR 625), WEFAX, KISS, NAVTEX/AMTEX, Host
All Others: Packet, WEFAX, KISS, Host

Other Features:
All units: PBBS, KA-NODE
KAM, KPC-4: Dual-port with gateway and cross-connect

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KAM Parts List

C1 – .01uf
C2 – .01uf
C3 – .1uf
C4 – .001uf
C5 – .001uf
C6 – .001uf
C7 – 1uf Alum
C8 – .001uf
C9 – .001uf
C10 – .1uf
C11 – .001uf
C12 – .001uf
C13 – .1uf
C14 – .1uf
C15 – 1uf Alum
C16 – .1uf
C17 – .001uf
C18 – 1 uf Alum
C19 – 47uf Alum
C20 – 47uf Alum
C21 – .001uf
C22 – .1uf
C23 – .1uf
C24 – .01uf
C25 – 20pf
C26 – 20pf
C27 – .1uf
C28 – .1uf
C29 – 1uf Alum
C30 – .01uf
C31 – .01uf
C32 – 4.7uf Alum
C33 – 4.7uf Alum
C34 – .01uf
C35 – .01uf
C36 – 330pf
C37 – .01uf
C38 – .1uf
C39 – 10uf Tant
C40 – .1uf
C41 – .1uf
C42 – 10uf 50V Alum
C43 – 10uf 50V Alum
C44 – .1uf
C45 – .001uf
C46 – .1uf

C48 – .1uf
C49 – 25pf
C50 – 33pf
C51 – .1uf
C52 – .1uf
C54 – .1uf
C55 – .1uf
C56 – .01uf
C57 – .001uf
C58 – .001uf
C59 – .001uf
C60 – .001uf
C61 – .001uf
C62 – .1uf

CR1 – 1N4003
CR2 – 1N4003
CR3 – 1N4003
CR4 – 1N4003
CR5 – 1N914
CR6 – 1N914
CR7 – 1N914
CR8 – 1N914
CR9 – 1N914
CR10 – 1N914
CR11 – 1N914
CR12 – 1N914
CR13 – 1N914
CR14 – 1N914
CR15 – 1N914
CR16 – 1N914
CR17 – 1N4003
CR18 – 1N4003
CR19 – 1N914
CR20 – 1N914
CR21 – 1N914

J1 – 2.5 mm Barrel
J2 – 9 Pin - D
J3 – 8 Pin Din
J4 – 25 Pin - D

K1 – 3 Pin
K2 – 3 Pin
K3 – 2 Pin
K4 – 2 Pin
K5 – 3 Pin
K6 – 3 Pin
K7 – 3 Pin
K8 – 20 Pin
K9 – 6 Pin

L1 – GREEN
L2 – GREEN
L3 – GREEN
L4 – GREEN
L5 – RED
L6 – GREEN
L7 – GREEN
L8 – RED

Q1 – PN2222
Q2 – PN2222
Q3 – PN2222
Q4 – PN2222
Q5 – PN2907A
Q6 – 2N7000
Q7 – PN2907A
Q8 – PN2907A
Q9 – PN2222
Q10 – PN2907A
Q11 – PN2222

R1 – 620
R2 – 620
R3 – 10K
R4 – 100K
R5 – 620
R6 – 47K
R7 – 10K
R8 – 4.7K
R9 – 6.8K
R10 – 620
R11 – 220
R12 – 1K
R13 – 100K
R14 – 1M
R15 – 1M
R16 – 1M
R17 – 470
R18 – 47K
R19 – 2.2K
R20 – 10K
R21 – 1M
R22 – 10K
R23 – 10K
R24 – 1.5K
R25 – 10K
R26 – 6.8K
R27 – 15K
R28 – 15K
R29 – 10K
R30 – 22K
R31 – 150K
R32 – 150K
R33 – 100K
R34 – 100K
R35 – 2.7K
R36 – 1.2K

R37 – 15K
R38 – 10K MF
R39 – 33K
R40 – 9.1K
R41 – 8.45K MF
R42 – 2.7K
R43 – 22K
R44 – 10K
R45 – 680K
R46 – 620K
R47 – 220K
R48 – 10K
R49 – 5.1K
R50 – 15K
R51 – 9.53K MF
R52 – 82K
R53 – 220K
R54 – 100K
R55 – 150K
R56 – 150K
R57 – 150K
R58 – 33K
R59 – 33K
R60 – 2.7K
R61 – 1.2K
R62 – 15K
R63 – 5.1K
R64 – 82K
R65 – 9.53K MF
R66 – 68K
R67 – 47K
R68 – 100K
R69 – 150K
R70 – 22K
R71 – 68K
R72 – 100K
R73 – 100K
R74 – 1M
R75 – 220
R76 – 180K
R77 – 100K
R78 – 100K
R79 – 100K
R80 – 2.2K
R81 – 22K
R82 – 2.2K
R83 – 100K
R84 – 9.1K
R85 – 100K
R86 – 2.2K
R87 – 220
R88 – 220

R90 – 620
R91 – 1M
R92 – 2.2K
R93 – 1K
R94 – 2.2K
R95 – 10K
R96 – 100K
R97 – 6.8K
R98 – 100K
R99 – 33K
R100 – 1K
R101 – 1K
R102 – 10K
R103 – 100K
R104 – 51K
R105 – 10K
R106 – 6.8K
R107 – 100
R108 – 100K
R109 – 120K
R110 – 270
R111 – 270
R112 – 6.8K
R113 – 270

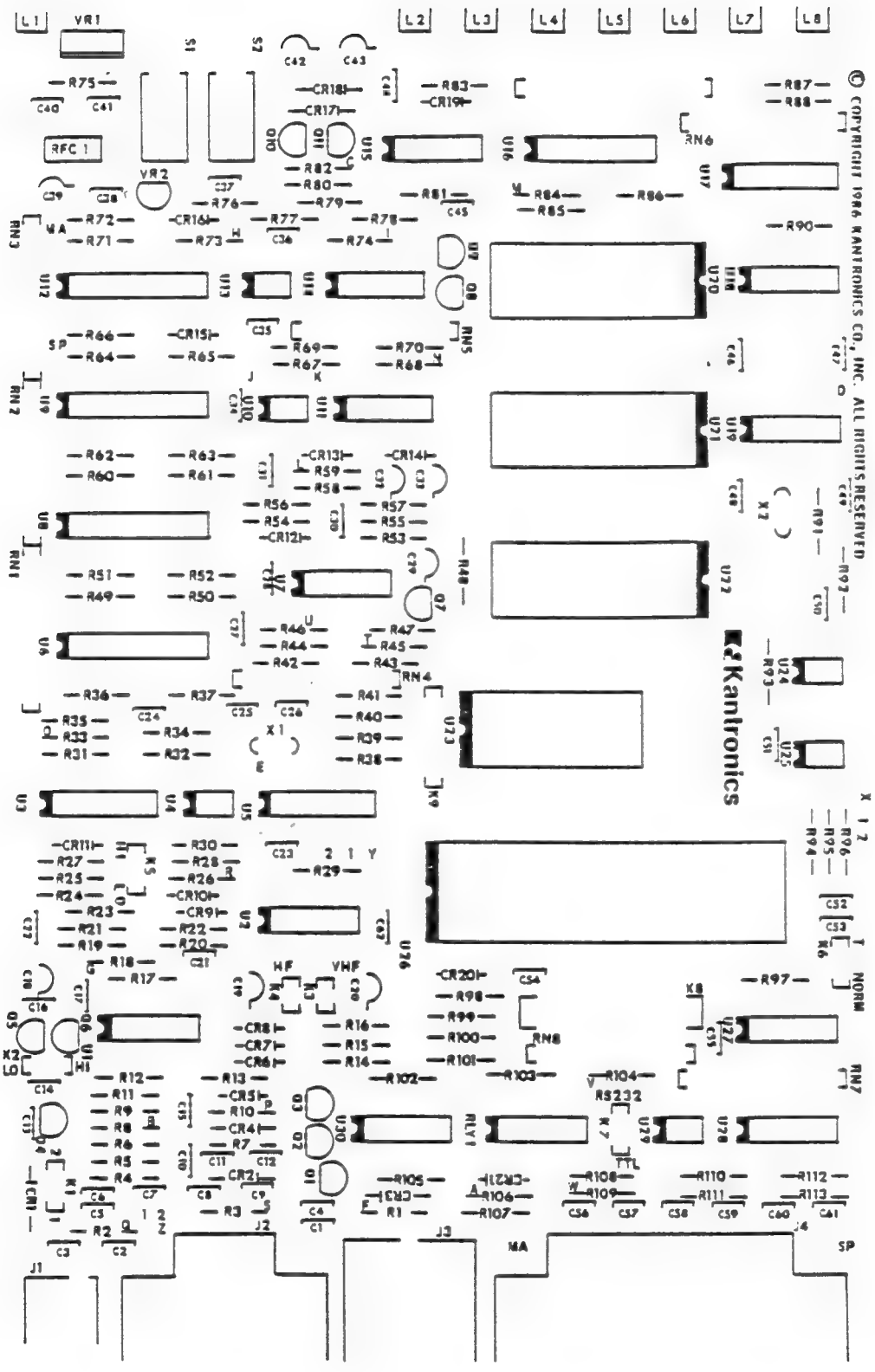
RFC1– 10uh

S1 – PUSH PUSH
S2 – PUSH PUSH

U1 – MC34074
U2 – 74HC04
U3 – 4018
U4 – MF4CN
U5 – TCM3105
U6 – MF10CN
U7 – LM339
U8 – MF10CN
U9 – MF10CN
U10 – MF4CN
U11 – LM324
U12 – MF10CN
U13 – LM358
U14 – 4066
U15 – 4069
U16 – LM3914
U17 – 74HC259
U18 – 74HC10
U19 – 74HC04
U20 – SPARE
U21 – 42832
U22 – 27C256
U23 – 71054
U24 – SPARE
U25 – X2404
U26 – 63B03X
U27 – 4070
U28 – MC34074
U29 – LM358
U30 – LM339

VR1 – 78M05 +5v Reg
VR2 – 79L05 -5v Reg

RN1 – 10K
RN2 – 10K
RN3 – 10K
RN4 – 10K
RN5 – 10K
RN6 – 220K
RN7 – 100K
RN8 – 10K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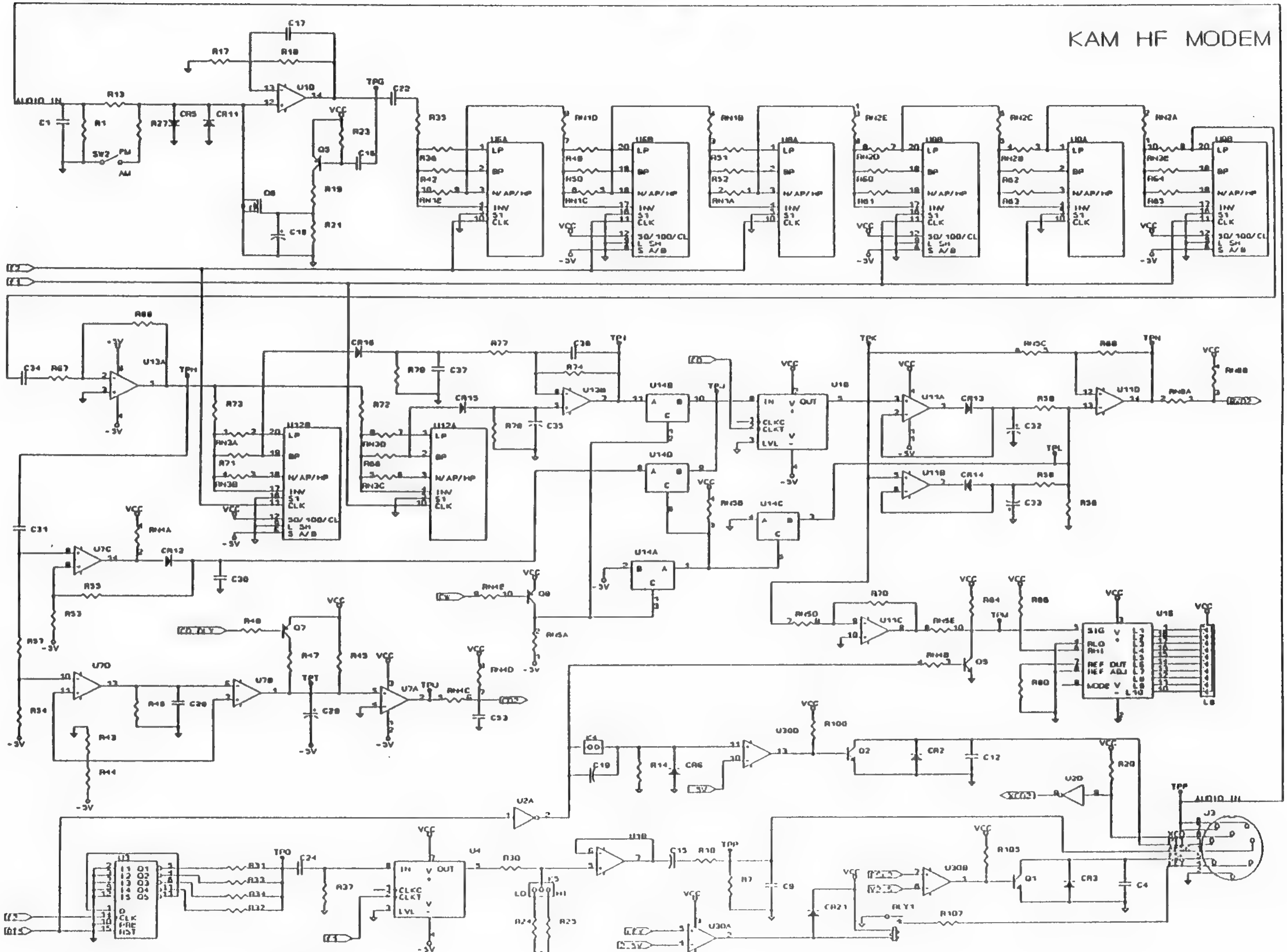
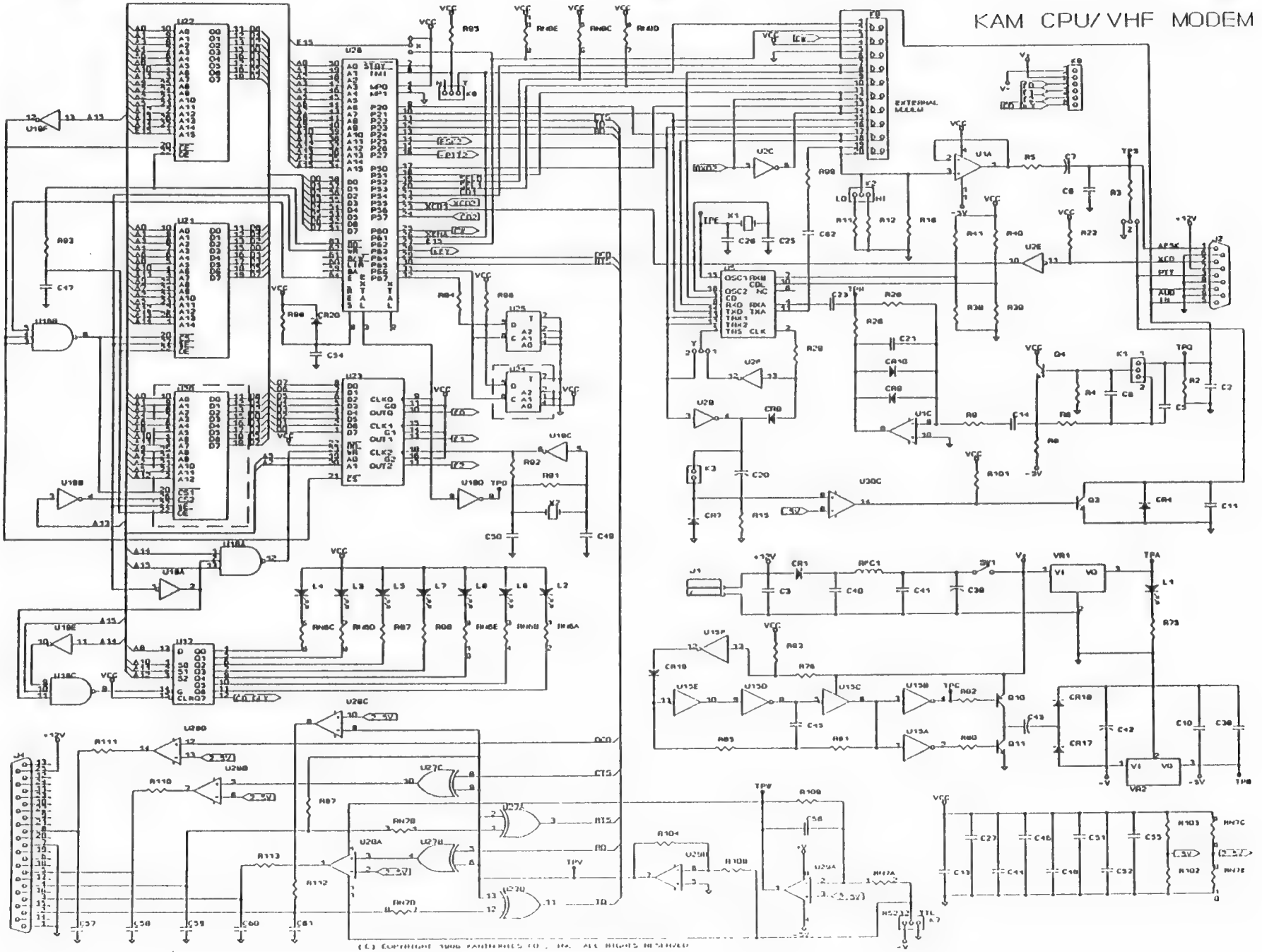
Kantronics
L1
L2
L3
L4
L5
L6
L7
L8
VR1
VR2
RFC 1
X1
X2
HF
VHF
RS232
NORM
MA
SP
J1
J2
J3
J4

KAM HF MODEM



KAM CPU/VHF MODEM



KPC-4 Parts List

C1 – .1
C2 – 20pf
C3 – 20pf
C4 – .001
C5 – .001
C6 – .001
C7 – .01
C8 – .001
C9 – .01
C10 – .1
C11 – .001
C12 – .001
C13 – 1uf
C14 – 1uf
C15 – .001
C16 – .001
C17 – .1
C18 – .1
C19 – .1
C20 – .001
C21 – .001
C22 – .1
C23 – .1
C24 – .1
C25 – .1

C28 – 47uf
C29 – 47uf
C30 – .1uf
C31 – 20pf
C32 – 20pf
C33 – .1
C34 – .1
C35 – 10uf Tant
C36 – .1
C37 – .1
C38 – 4.1
C39 – .1
C40 – 10
C41 – 10
C42 – .1
C43 – .001
C44 – .1
C45 – .1
C46 – .1
C47 – .1
C48 – .1
C49 – .1
C50 – .01
C51 – .001
C52 – .001
C53 – .001
C54 – .001
C55 – .001
C56 – .001
C57 – .1

CR1 – 1N914
CR2 – 1N914
CR3 – 1N914
CR4 – 1N914
CR5 – 1N914
CR6 – 1N914
CR7 – 1N914
CR8 – 1N4001
CR9 – 1N4001
CR10 – 1N4001
CR11 – 1N4001
CR12 – 1N4001
CR13 – 1N914

Q1 – PN2222
Q2 – PN2222
Q3 – PN2222
Q4 – PN2222
Q5 – PN2907
Q6 – 2N2222

R1 – 100K
R2 – 100K
R3 – 10K
R4 – 620
R5 – 620
R6 – 100K
R7 – 10K
R8 – 10K
R9 – 100K
R10 – 47K
R11 – 4.7K
R12 – 4.7K
R13 – 47K
R14 – 620
R15 – 10K
R16 – 10K
R17 – 620
R18 – 15K
R19 – 6.8K
R20 – 6.8K
R21 – 15K
R22 – 6.8K
R23 – 1K
R24 – 1M
R25 – 220
R26 – 6.8K
R27 – 220
R28 – 1M
R29 – 1K
R30 – 33K
R31 – 33K
R32 – 8.45 K
R33 – 10K
R34 – 2.2K

R39 – 9.1K
R40 – 33K
R41 – 2.2K
R42 – 1M
R43 – 1M
R44 – 1M
R45 – 10K
R46 – 100K
R47 – 1K
R48 – 1K
R49 – 100K
R50 – 10K
R51 – 220
R52 – 2.2K
R53 – 2.2K
R54 – 100K
R55 – 22K
R56 – 220
R57 – 220
R58 – 220
R59 – 100K
R60 – 2.2K
R61 – 100K
R62 – 10K
R63 – 6.8K
R64 – 51K
R65 – 100K
R66 – 120K
R67 – 6.8K
R68 – 270
R69 – 270
R70 – 6.8K
R71 – 270

RFC1 – 10uh

S1P1 – 220
S1P2 – 100K
S1P3 – 10K

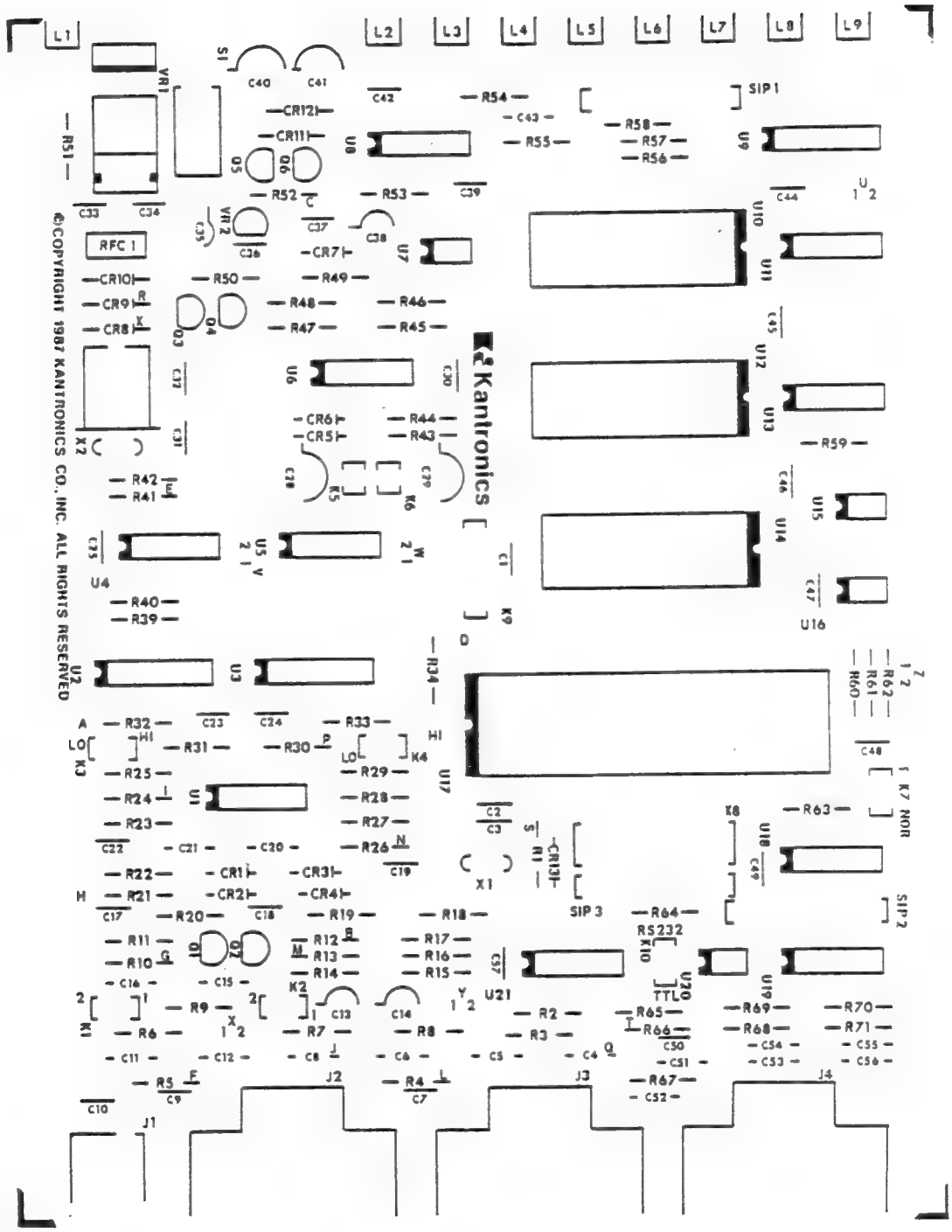
U1 – MC34074
U2 – 3105
U3 – 3105

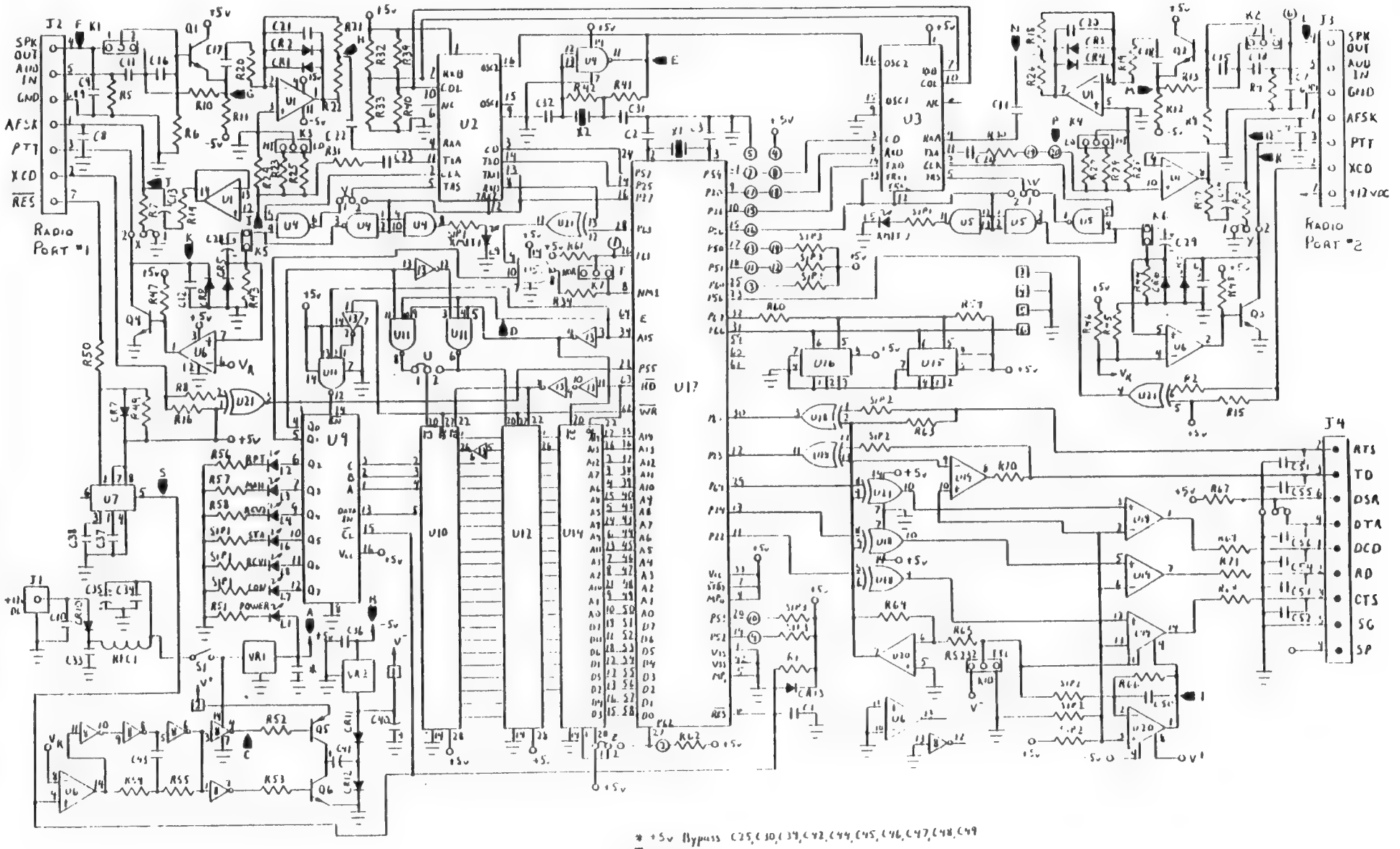
U4 – 74HC00
U5 – 74HC00
U6 – LM339
U7 – TL7705
U8 – 4069
U9 – 74HC259
U11 – 74HC10
U12 – 42832
U13 – 74HC04
U14 – 27C256
U16 – 2404
U17 – 63B03X
U18 – 4070
U19 – MC34074
U20 – LM358
U21 – 4070

VR1 – 78M05
VR2 – 79L05

X1 – 7.3728MHz
X2 – 4.4336MHz

KPC-4 COMPONENT PLACEMENT DIAGRAM





* +5v Bypass C25, C30, C39, C42, C44, C45, C46, C47, C48, C49

KPC-2 Parts List

C1 – 10uf Tant
C2 – .001 Disc
C3 – 4.7 uf Alum
C4 – 4.7 uf Alum
C5 – .1 MLC
C6 – .1 MLC
C7 – .1 MLC
C8 – .1 MLC
C9 – .1 MLC
C10 – .002 Disc
C11 – 20 pf
C13 – .1 MLC
C14 – .1 MLC
C15 – .01 Disc
C16 – .01 Disc
C17 – .001 MLC
C18 – .01 Disc
C19 – .1 ML
C20 – .01 Disc
C21 – .001 Disc
C22 – .001 Disc
C23 – 1 uf Alum
C24 – .01 Disc
C25 – .001 Disc
C26 – .001 Disc
C27 – .001 Disc
C28 – .001 Disc
C29 – .001 Disc
C30 – .001 Disc
C31 – 20 pf
C32 – 20 pf
C34 – .1 MLC
C35 – .1 MLC
C36 – .1 MLC
C37 – .1 MLC
C38 – .1 MLC
C39 – .1 MLC

CR1 – 1N914
CR2 – 1N4003
CR3 – 1N4003
CR4 – 1N4003
CR5 – 1N914
CR6 – 1N914
CR7 – 1N914
CR8 – 1N914
CR9 – 1N4003
CR10 – 1N914

J1 – power jack
J2 – 9 pin D-connector
J3 – 3.5 audio jack
J4 – 25 pin D-connector

K-1 3 pin header
K-2 3 pin header
K-3 3 pin header

L-1 Red LED
L-2 Red LED
L-3 Red LED
L-4 Red LED
L-5 Green LED

N1 J5
Q1 M1 jumper
hole 9-10

Q1 – PN2907A
Q2 – PN2222
Q3 – PN2222

R1 – 100K
R2 – 120K
R3 – 100K
R4 – 4.7K
R5 – 22K
R6 – 4.7K
R7 – 1M
R8 – 100
R9 – 100K
R10 – 33K
R11 – 100K
R12 – 100 ohm
R13 – 1M
R14 – 470
R15 – 100K
R16 – 3.3K
R17 – 4.7K
R18 – 620
R19 – 620
R20 – 10K
R21 – 270
R22 – 270
R23 – 270
R24 – 6.8K
R25 – 6.8K
R26 – 6.8K
R27 – 120K
R29 – 100K
R30 – 51K
R31 – 120K
R32 – 10K
R33 – 100K
R34 – 10K
R35 – 100K
R36 – 10K
R37 – 2.2K
R38 – 100K
R39 – 4.7K
R40 – 220
R41 – 220
R42 – 220
R43 – 220
R44 – 220

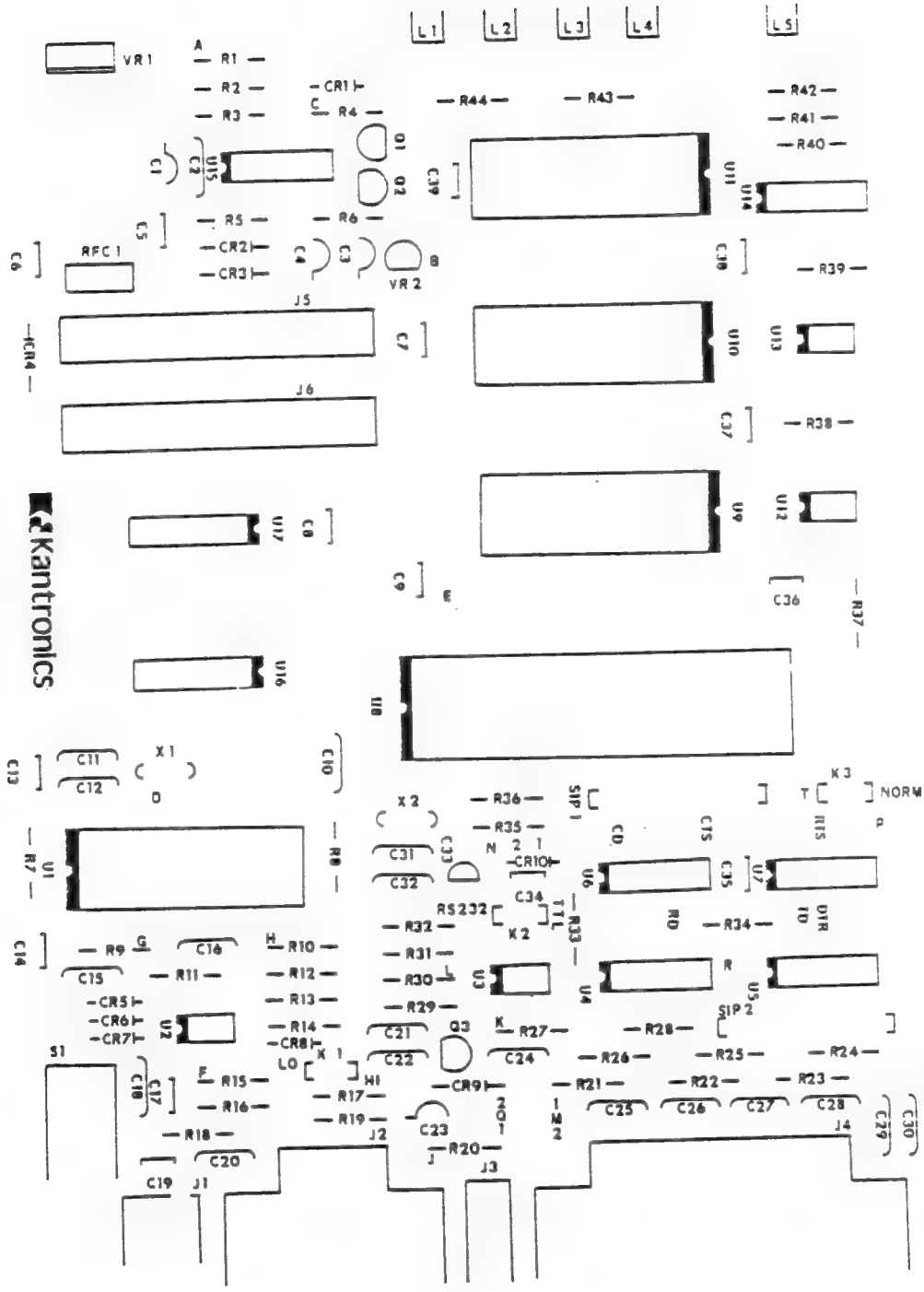
RFC1 – 10uh
S1 – push push switch

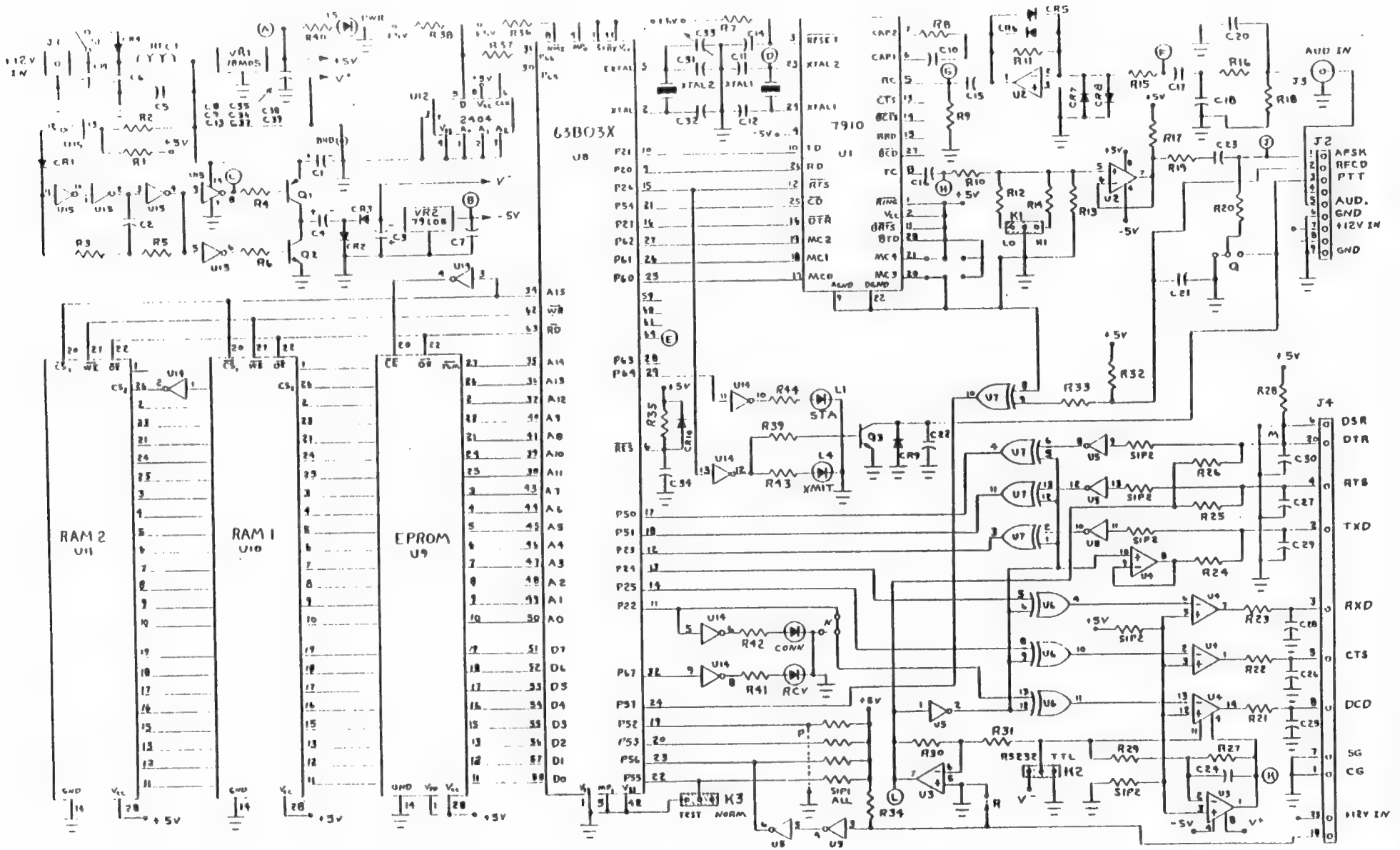
S1P1 – 10K
S1P2 – 100K

U1 – 7910 28 pin socket
U2 – LM358
U3 – LM358
U4 – MC34074
U5 – 74HC14
U6 – 4070
U7 – 4070
U8 – 63B03X 64 pin socket
U9 – 27256 28 pin socket
U11 – 62256 25 pin socket
U12 – 2404 8 pin socket
U14 – 74HC04
U15 – 4069

VR1 – 78M05
VR2 – 79L05

XTAL 1 – 2.4576 MHz
XTAL 2 – 7.3728 MHz


Kantronics
VR1
VR2
RFC1
L1
L2
L3
L4
L5
J1
J2
J3
J4
J5
J6
S1
X1
X2
K1
K2
K3
NORM
RS232
TTL
SIP1
SIP2
LO
HI
Q1
Q2
Q3
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18


63B03X
U8
7910
U1
2404
U12
RAM 2
U11
RAM 1
U10
EPROM
U9
AUD IN
J3
J2
APSK
RFCD
PTT
AUD.
GND
+12V IN
GND
J4
DSR
DTR
RTS
TXD
RXD
CTS
DCD
SG
CG
+12V IN
STA
XMIT
CONN
RCV
TEST
NORM
K1
K2
K3
RS232
TTL
SIP1
ALL
SIP2
+5V
-5V
+8V

KPC-2400 Parts List

R1 – 620ohm
R2 – 22K
R3 – 100K
R4 – 8.2K
R5 – 4.7K
R6 – 47K
R7 – 4.7K
R8 – 33K
R9 – 10K
R10 – 18K
R11 – 470K
R12 – 470ohm
R13 – 47K
R14 – 470K
R15 – 10K
R16 – 4.7K
R17 – 100K
R18 – 1Meg
R19 – 910ohm
R20 – 2.2K
R21 – 1Meg
R22 – 100K
R23 – 100K
R24 – 100K
R25 – 1Meg
R26 – 47K
R27 – 470ohm
R28 – 33K
R29 – 47K
R30 – 220ohm
R31 – 47K
R32 – 1K
R33 – 10K
R34 – 100ohm
R35 – 1Meg
R36 – 1Meg
R37 – 2.2K
R38 – 150K
R39 – 2.2K
R40 – 4.7K
R41 – 10K
R42 – 33K
R43 – 100K
R44 – 15K
R45 – 9.09K MF
R46 – 15K
R47 – 9.09K MF
R48 – 33K
R49 – 100K
R50 – 15K
R51 – 9.53K MF
R52 – 68K
R53 – 18K
R54 – 33K
R55 – 18K
R56 – 9.53K MF
R57 – 68K
R58 – 180K
R59 – 4.7K
R60 – 4.7K
R61 – 100K
R62 – 100K
R63 – 22K
R64 – 220ohm
R65 – 220ohm
R66 – 220ohm
R67 – 220ohm
R68 – 220ohm
R69 – 4.7K
R70 – 100K
R71 – 2.2K
R72 – 10K
R73 – 100K
R74 – 100K
R75 – 120K
R76 – 68K
R77 – 100K
R78 – 10K
R79 – 620ohm
R80 – 120K
R81 – 6.8K
R82 – 6.8K
R83 – 6.8K
R84 – 270ohm
R85 – 270ohm
R86 – 270ohm
R87 – 10K
R88 – 100K

RFC1 – 10uh

XTAL 1 – 7.3728 MHz
XTAL 2 – 2.4576 MHz
XTAL 3 – 4.608 MHz

S1P 1 – 100K
S1P 2 – 100K
S1P 3 – 100K

C1 – .1
C2 – .01
C3 – .001
C4 – .001
C5 – .001
C6 – .001
C7 – .1

C9 – 1uf Alum
C10 – .1
C11 – .1
C12 – .001
C13 – .1
C14 – .01
C15 – .1
C16 – .002
C17 – 20pf

C19 – 33pf
C20 – 33pf
C21 – .1
C22 – .1
C23 – .01 Disc
C24 – .01 Disc
C25 – .1
C26 – 10uf
C27 – .1
C28 – 10uf Alum
C29 – 10uf Alum
C30 – .1
C31 – .001
C32 – .1
C33 – .1
C34 – .1
C35 – 20pf
C36 – 20pf
C37 – .1
C38 – .1
C39 – .1
C40 – .01 Disc
C41 – 1uf Alum
C42 – .001
C43 – .001
C44 – .001
C45 – .001
C46 – .001
C47 – .001
C48 – .001
C49 – .001

CR1 – 1N4001
CR2 – 1N914
CR3 – 1N914
CR4 – 1N914

CR5 – 1N914
CR6 – 1N915
CR7 – 1N4001
CR8 – 1N4001
CR9 – 1N914
CR10 – 1N914
CR11 – 1N4001

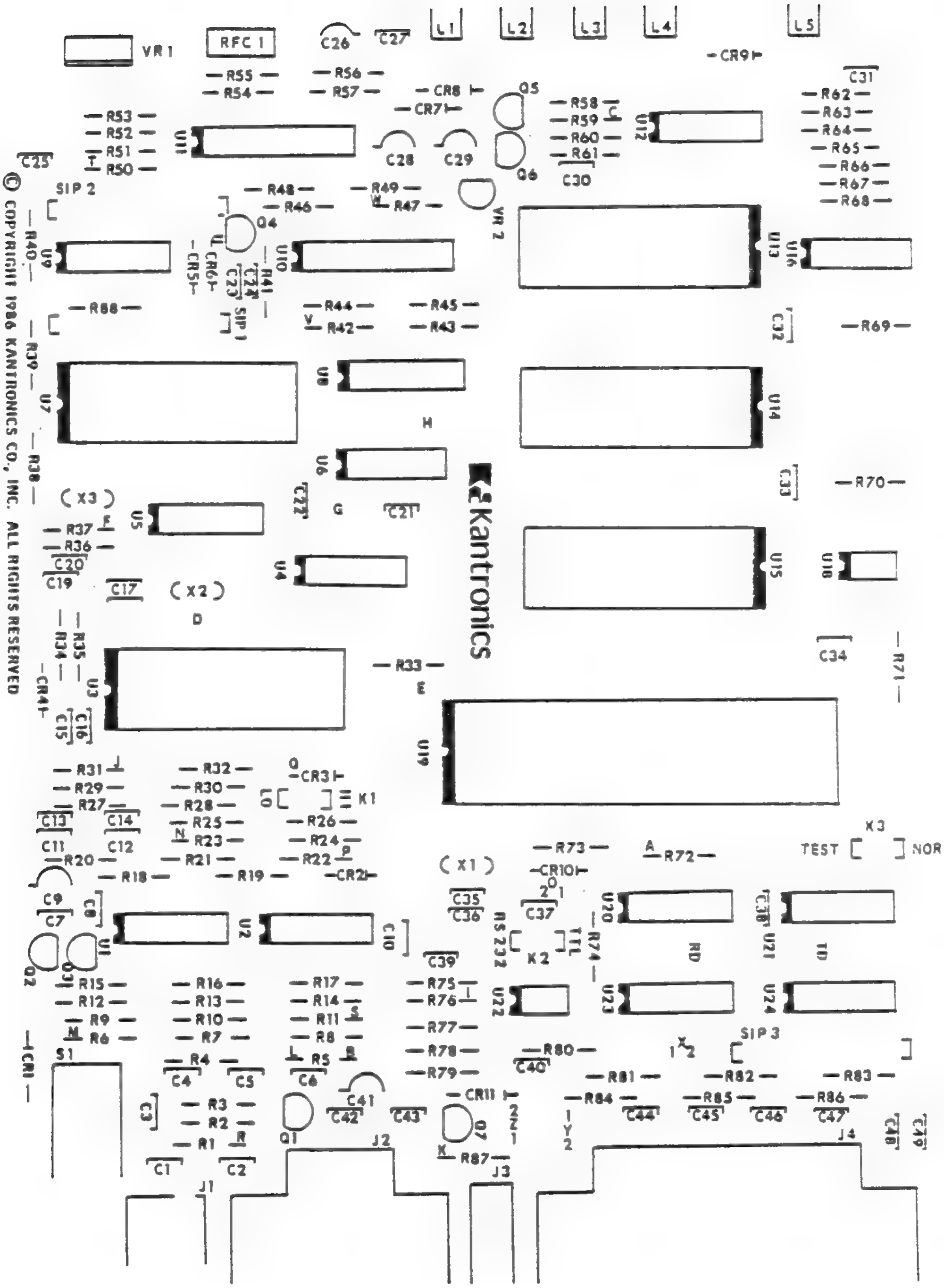
Q1 – PN2222
Q2 – PN2907A
Q3 – 2N7000
Q4 – PN2222
Q5 – PN2907A
Q6 – PN2222
Q7 – PN2222

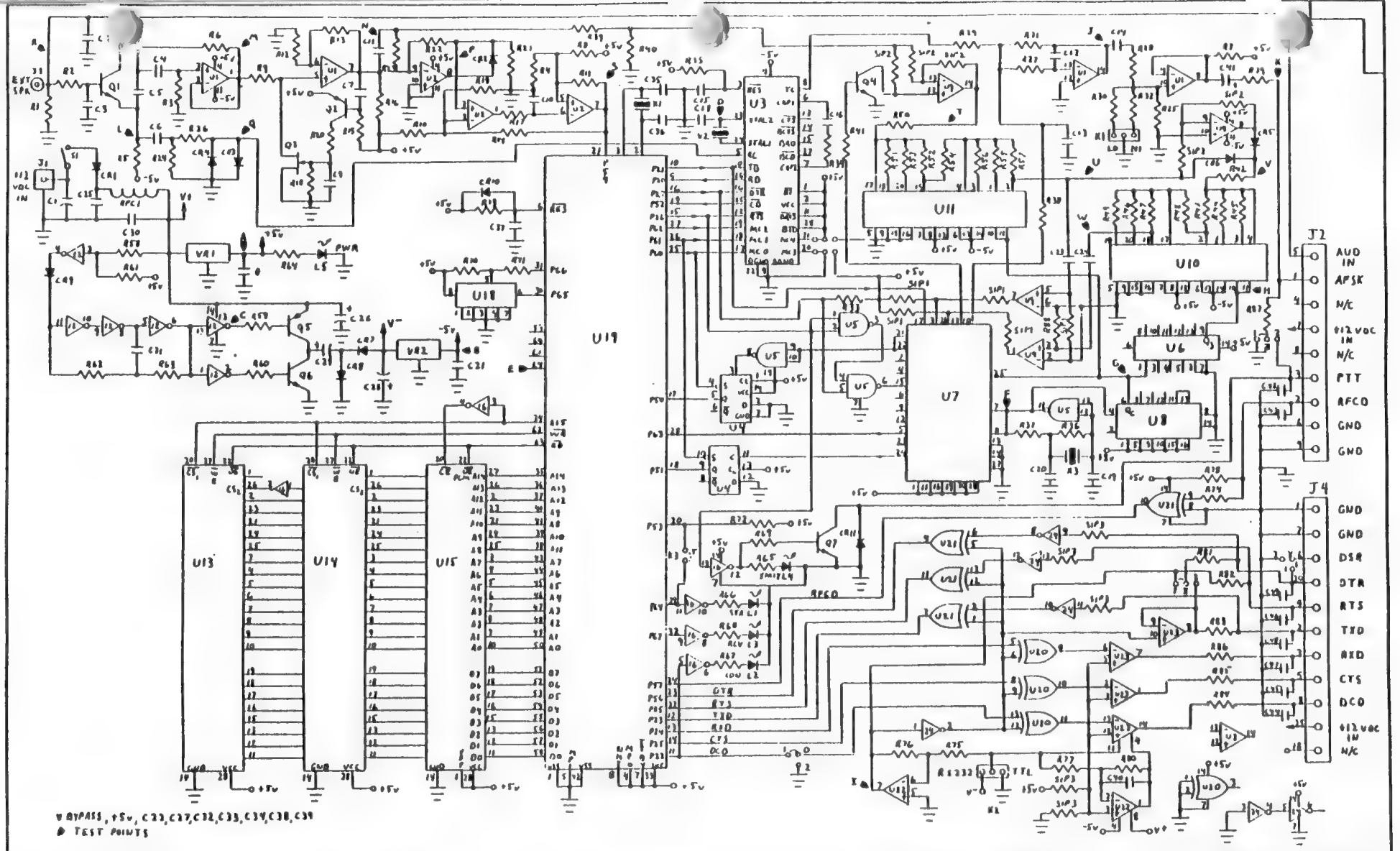
VR1 – 78MO5
VR2 – 79L05

L1 – Red LED
L2 – Red LED
L3 – Red LED
L4 – Red LED
L5 – Green LED

U1 – MC33074
U2 – LM324
U3 – 7910
U4 – 74HC74
U5 – 74HC00
U6 – 4024
U7 – P423
U8 – 74HC193
U9 – MC33074
U10 – MF-10
U11 – MF-10
U12 – 4069
U13 – empty
U14 – 62256
U15 – 27256
U16 – 74HC04

U18 – X2404
U19 – 63B03X
U20 – 4070
U21 – 4070
U22 – LM358
U23 – MC33074
U24 – 74HC14


Kantronics
© COPYRIGHT 1986 KANTRONICS CO., INC. ALL RIGHTS RESERVED
TEST
NOR
RS 232
TTL
RD
TD



▼ BYPASS, +5v, C23, C27, C32, C33, C34, C38, C39
● TEST POINTS

REV	DATE	DESCRIPTION	BY

REV	DATE	DESCRIPTION	BY

Kantronics
(913) 842-7745
1202 E. 23rd Street
Lawrence, Kansas 66044

COMMENTS

TITLE
KPC-2400
CIRCUIT SCHEMATIC
PC-36

NUMBER

DRAWN BY: J. Kerns — DATE: 6-87
CHK'D BY — DATE
ENGINEER — DATE
SCALE

Index

C: means found in Commands Manual
O: means found in Operations Manual
I: means found in Installation Manual
CAPITAL entry signifies a TNC command or directive